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AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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Abstracts in *STAR* are grouped by specific category, the categories appearing in sequential order. Category breaks in the abstract section are identified by the category number and title, and a scope note. Cross-references to other categories are provided as appropriate. For example:

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

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Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 688
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 690
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 692
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 692
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

92 SOLAR PHYSICS 692
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 693
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

GENERAL

99 GENERAL 693

Note: N.A. means that no abstracts were assigned to this category for this issue.

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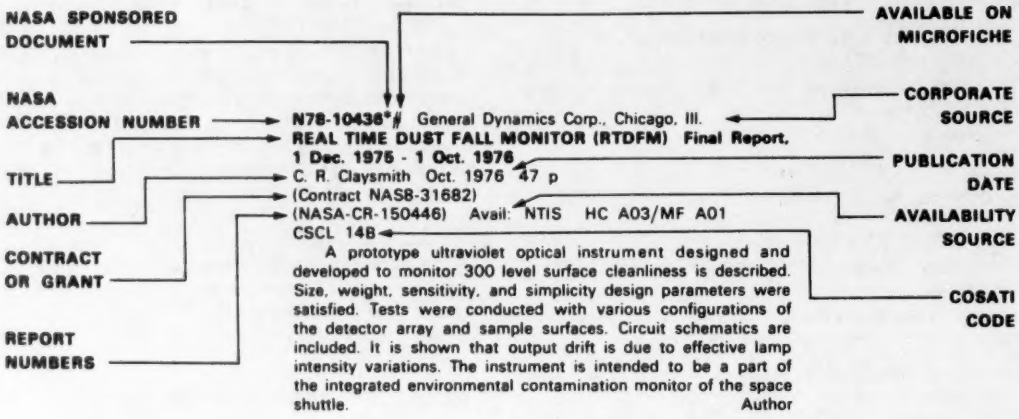
TYPICAL CITATION AND ABSTRACT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N78-10436*# General Dynamics Corp., Chicago, Ill.
CORPORATE SOURCE
REAL TIME DUST FALL MONITOR (RTDFM) Final Report, 1 Dec. 1975 - 1 Oct. 1976
TITLE
PUBLICATION DATE
C. R. Claysmith Oct. 1976 47 p
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(Contract NAS8-31682)
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(NASA-CR-150446) Avail: NTIS HC A03/MF A01
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REPORT NUMBERS
A prototype ultraviolet optical instrument designed and developed to monitor 300 level surface cleanliness is described. Size, weight, sensitivity, and simplicity design parameters were satisfied. Tests were conducted with various configurations of the detector array and sample surfaces. Circuit schematics are included. It is shown that output drift is due to effective lamp intensity variations. The instrument is intended to be a part of the integrated environmental contamination monitor of the space shuttle.
Author

ON-GOING RESEARCH PROJECTS

This is a listing of research projects – not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, ADVANCED SIMULATOR FOR PILOT TRAINING
M.E. WOOD, U.S. Air Force, Flying Training Division, *Chandler, Arizona* 85224 (DF22186.2; F33615-78-C-0003)

To permit an investigation of state-of-the-art simulation in pilot training with the objective of determining the effectiveness of motion and advance instructional features in high-fidelity devices. The impact of these evaluations will be to provide a heretofore unobtainable data bank from which design characteristics for future simulators may be determined. This includes all known visual and performance characteristics (up to the maximum capabilities of the installed system). The findings will be relevant to all simulation users in the DOD. In addition, engineering design changes will be investigated to determine simulator acceptability. Records on simulator reliability, spares and maintenance costs will be documented. The final output will be a capability to test various levels of stated simulator requirements and to validate these needs against training capability, thereby providing more realistic procurement cost estimates, and subsequently, cost avoidance forecasts. The research is planned to be conducted on four levels: I) The study of the basic components of simulation; II) The examination of the interaction of those components; III) The experimental investigation of candidate simulator devices, and their substitutive value for aircraft training; and lastly, IV) The development of pilot training syllabi which incorporate the optimum mix of simulator and aircraft training.

ADDENDA: Supporting agency address is: Headquarters, Air Force Human Resources Laboratory (AFSC), Brooks AFB, TX 78235.

SUPPORTED BY U.S. Dept. of Defense, Air Force

1.0002, IMPROVED SURGE MARGIN CENTRIFUGAL COMPRESSOR
R. CLARKE, Signal Companies Incorporated, *Phoenix, Arizona* 85034 (DA0D3999; DAAJ02-75-C-0033)

The objective is to investigate experimentally the factors critical to centrifugal compressor flow range, surge, and efficiency flow characteristics, and subsequently, to demonstrate a single-stage, high-pressure-ratio centrifugal compressor having peak performance on or near a projected engine operating line. Achievement will result in approximately a four-point improvement over current operating line efficiency with a predicted 6-8 percent reduction in fuel consumption and its attendant potential for increased range and/or payload for future Army helicopters.

Design a baseline 10-1 pressure ratio compressor having a geometry favorable to broad flow range and a numer of modifications thereof varying geometrical/aero factors critical to flow range and efficiency. fabricate, test and analyze data to formulate design correlations for the critical factors. Use the correlations to design, fabricate and test an optimum compressor stage.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0003, ADVANCED TECHNOLOGY SERVICING EQUIPMENT FOR ARMY AIRCRAFT
R.R. MEJDRICH, Signal Companies Incorporated, *Phoenix, Arizona* 85034 (DA0D4054; DAAJ02-76-C-0042)

Develop improved aircraft servicing systems and equipment and operating unit ground maintenance capabilities to achieve significant reductions in turnaround time between missions, and improved equipment to enhance required maintenance capability at the operating unit or intermediate support levels.

Contract with qualified servicing and maintenance equipment manufacturers to evaluate, select and develop optimum concepts for improved technology servicing and ground maintenance equipment for use at the operational unit or intermediate support levels.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0004, AH-1G MAIN ROTOR BLADE LOW RADAR CROSS SECTION EROSION PROTECTION INTEGRATION PROGRAM
R.E. HEAD, Hughes Aircraft Company, *Culver City, California* 90230 (DA0D4031; DAAJ02-76-C-0008)

To develop, fabricate, and environmentally test a rotor blade leading edge elastomeric erosion protection strip. This erosion strip will provide protection for present and future composite helicopter rotor blades which have the inherent potential of low radar cross section (RCS).

This effort will be performed in three tasks: erosion material review and selection, erosion specimen fabrication and environmental testing, and low RCS test specimen fabrication and testing. Each task, as completed, will provide input to the following task to effect the optimum erosion protection for rotor blade leading edges.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Air Mobility Research & Development Lab.

1.0005, EVALUATION OF A CIRCULATION CONTROL TAIL BOOM FOR YAW CONTROL
A.H. LOGAN, Hughes Aircraft Company, *Culver City, California* 90230 (DA0D4103; DAAJ02-77-C-0018)

To evaluate the ability of a circulation control tail boom to provide effective antitorque force over a typical helicopter flight regime.

A government-furnished OH-6A aircraft with an experimental tail boom which uses circulation control principles to produce an antitorque force will be modified and flight tested.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Air Mobility Research & Development Lab.

1.0006, NONLINEAR STUDIES OF TRANSITION TO TURBULENCE IN FLUID FLOWS 10112-E
R.E. KELLY, Univ. of California, School of Engin. & Appl. Sci., *Los Angeles, California* 90024 (DA0D8969; DA-ARO(D)-31-124-72-G168)

To elucidate all mechanisms involved in transition of fluid motion from laminar to turbulent. This study is concerned with the phenomenon of transition from laminar to turbulent flow, such as occurs in the flow of air over ballistic projectiles, missiles, the wings of conventional aircraft and the rotors of helicopters.

An analytic study will be made of nonlinear aspects of three related problems in hydrodynamic stability: (1) Investigation of spanwise vortex structure characteristic of boundary layers undergoing transition at low levels of free-stream turbulence. (2) Investigation of the critical layer structure in a shear flow when nonlinear and viscous effects are important. (3) Study of the effect of secondary flows and nonplanar effects on shear instabilities.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Army Research Office

1.0007, AERONAUTICAL RESEARCH, TECHNICAL AREA D - RESEARCH IN MATHEMATICS

I.C. STATLER, U.S. Army, Air Mobility Res. & Dev. Lab., *Moffett Field, California* 94035 (DA0C5004)

Conduct research in the application of mathematics to the numerical solution of transonic flow problems with particular emphasis on the rotary wing advancing blade unsteady three-dimensional flow to develop codes which can be utilized for rotor blade design. This research will be conducted in joint participation with the NASA-Ames Research Center to provide a technological base in the aerodynamics of rotary wing and other VSTOL aircraft. The objective is to expand the technologies in those areas which are most likely to impact improved operational and cost effectiveness, survivability and safety future of Army air mobile systems.

Rotary wing transonic codes are developed and tested on the simpler problems verified by available experimental data and exercised to determine the unique features of the rotary wing transonic flow problems. Results of these numerical experiments are utilized to determine the necessity of increasing the problem complexity to more fully represent the actual rotor flow problem. Earlier studies have indicated the importance of including the unsteady terms in the analysis and more recent theoretical and experimental results have defined the limitations of the two-dimensional analysis.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0008, AERONAUTICAL TECHNOLOGY, TECHNICAL AREA K - FLIGHT SIMULATION

I.C. STATLER, U.S. Army, Air Mobility Res. & Dev. Lab., *Moffett Field, California* 94035 (DA0D5000)

Perform analyses and design studies of the requirements of a rotary-wing R&D flight simulator capable of simulating NOE flight operations. Available simulation technology allows a total integrated systems approach to R&D involving conceptual designs, preliminary and detail design trade-offs, man-machine interactions, mission capabilities, support of flight tests, and product improvement evaluation.

In joint participation with NASA, perform the studies with the expectation of modifying an available NASA simulator to meet the Army's mission requirements.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Air Mobility Research & Development Lab.

1.0009, MAINTENANCE AND DIAGNOSTICS LOGIC MODEL

R.A. DEPAUL, Detex Systems Incorporated, *Orange, California* 92667 (DA0C3522; NAS PR A10240B)

The objectives are to investigate the feasibility of utilizing an advanced logic model and to develop a maintenance logic model for performing diagnostics and fault isolation of helicopter components.

The approach taken is to identify methodology for describing the functional and physical relationship of designed hardware by identifying appropriate dependency chains and utilizing such design variables as test points and feedback conditions to create a logic model useful to repairmen and maintenance specialists which will also be useful as a design evaluation tool for ease of maintenance and repair.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0010, ADVANCED MINI-RPV (REMOTELY PILOTED VEHICLE) RECOVERY SYSTEM

B. KURZ, Teledyne Industries Inc., *San Diego, California* 92112 (DA0D4065; DAAJ02-76-C-0048)

To provide timely solutions for acceptable Army methods for the field recovery of small (under 200 pounds) RPVs. Major emphasis to be placed on: deployability, air vehicle damage prevention, ground crew safety, minimum set-up/teardown, mobility, and minimum acquisition/life time cost.

In coordination with the RPV WSM, this effort will be directed at defining an advanced recovery system for the Army's mini-RPV which corrects identified deficiencies in current state-of-the-art hardware. This will include a survey of applicable technologies, the formulation of concept designs, and trade-off studies to identify and define 'most promising' recovery concepts. Subsequent year follow-on efforts will include separate contracts for the design, fabrication, and full-scale evaluation of recovery systems defined through these efforts.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Air Mobility Research & Development Lab.

1.0011, FEASIBILITY INVESTIGATION FOR LIFT PERFORMANCE INDICATOR SYSTEM

W.J. HARRIS, Signal Companies Incorporated, *Torrance, California* 90509 (DA0D4083; DAAJ02-76-C-0036)

To provide helicopter crews engaged in cargo delivery missions with accurate and timely information on actual aircraft lift status so that positive actions can be taken to insure maximum safe utilization of the aircraft total lift capability.

This effort is an extension of prior research and development in which various elements relating to a lift margin indicating system were evaluated and in which the feasibility of such a system was established. In FY76, a system analysis and design study will be conducted to establish means for applying available technology, e.g., power prediction, real-time atmospheric density measurements, aircraft weight measurement, residual rotor lift at ground idle speed, etc. Follow-on efforts will include the synthesis, design, fabrication and test of a breadboard system after analysis of results. A full-scale flightworthy hard and software system will be designed, fabricated and flight tested.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Air Mobility Research & Development Lab.

1.0012, HELICOPTER TRANSMISSION VIBRATION AND NOISE REDUCTION PROGRAM

R. BOSSLER, Kaman Aerospace Corporation, *Bloomfield, Connecticut* 06002 (DA0D3929; DAAJ02-74-C-0039)

To generate clear, concise and usable, analytical tools that would, during the design stage of a program, allow the design team the capability to perform trade studies that would yield drive train components that are dynamically quiet, with inherently longer life and reduced vibration and attendant noise levels.

(1) Construct analytical prediction technique and predict vibration/noise levels of baseline test transmission; (2) Test baseline transmission; (3) Refine analysis/design and fabricate components to reduce vibration/noise levels of baseline transmission; (4) Test modified transmission; (5) Compare results and conduct users' conference.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Air Mobility Research & Development Lab.

1.0013, FAILSAFE COMPOSITE ROTOR HUB CONCEPT
R. MAYERJAK, Kaman Aerospace Corporation, *Bloomfield, Connecticut* 06002 (DA0D3976; DAAJ02-75-C-0013)

Fiber-reinforced composited materials have demonstrated their applicability in high-performance aircraft structures such as helicopter rotor blades, wings, rudders and sections of fuselage. The feasibility of fabricating a helicopter main rotor hub using composite materials has been demonstrated under contract with Whittaker Corporation, Research and Development Division. The objective of this program is to develop improved low-cost failsafe rotor hub technology. The use of composite materials can both reduce initial cost and provide a failsafe structure at no increase in weight.

Evaluate new hub concepts for low cost, low weight, ballistic resistance, radar reflectivity, and reliability and maintainability aspects. The better concept will be selected for further development which will include element and assembly fabrication and testing. After analysis of the test results, the hub design will be updated. The CH-54B is the baseline for this design.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0014, DESIGN OF BALLISTIC-DAMAGE-TOLERANT CROSS BEAM TAIL ROTOR
B. SELLECK, Sikorsky Aircraft Company, *Stratford, Connecticut* 06602 (DA0D4088; DAAJ02-77-C-0004)

To design, fabricate, and evaluate a survivable four-blade cross beam tail rotor severance system applicable to the UTTAS class aircraft.

The proposed program shall be conducted by the following tasks: Task I - Concept Analysis - Contractor shall review all previous data of previous work relating to both main and tail rotor blade severance for application to a survivable cross beam tail rotor design. Task II -Design - Contractor shall design a tail rotor blade severance system based on results of Task I. Task III - System Fabrication and Evaluation - Contractor shall fabricate a prototype system and conduct lab tests to verify operation. Task IV - Flight Simulation Analysis - Contractor shall develop a computer program to simulate loss of tail rotor blades and examine the effects of blade separation on the helicopter.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Air Mobility Research & Development Lab.

1.0015, AUTOROTATION MANEUVER CHARACTERISTICS OF HELICOPTERS
R.E. STUDWELL, Sikorsky Aircraft Company, *Stratford, Connecticut* 06602 (DA0D4077; DAAJ02-76-C-0066)

A mathematical model for evaluating the autorotation landing capability of current and future Army helicopters shall be established. An analytical investigation will then be conducted to delineate the sensitive parameters and limits that affect the quality of the autorotative entry and landing of helicopters.

The modification of an existing analytical method shall be performed resulting in an efficient and economical computerized mathematical model for the evaluation of the autorotative capability of current and advanced helicopter systems. Through the previously modified computer evaluation technique, sensitive or limiting parameters affecting AH-1G, UH-1D, OH-6A, and OH-58A helicopter autorotation entry and landing capabilitiies will be determined with baseline aircraft results compared with flight test data. In addition, an autorotation landing index based on energy and time factors shall be computed and catalogued for the subject baseline helicopters.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0016, HIGH-TEMPERATURE RADIAL TURBINE DEMONSTRATION
D. MONSON, General Motors Corporation, *Indianapolis, Indiana* 46206 (DA0D4113; DAAJ02-77-C-0031)

To provide and demonstrate the technology required to economically manufacture a cooled, high temperature, radial turbine with sufficient integrity and aerodynamic performance to meet future army requirements for reliable, low cost, high performance, small gas turbine engines.

The program will be conducted in three phases- phase i - detailed design and manufacturing process development phase ii - fabrication phase iii- mechanical integrity verification the process will consist of casting the rotor blades with internal cooling passages utilizing existing techniques. This is followed by hot-isostatic-press (hip) bonding the blades to a previously formed powder metal hub.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0017, ASSESSMENT OF ARMY HELICOPTER COMPONENT DIAGNOSTIC ERRORS
D. MANAHAN, Cobro Corporation, *Silver Spring, Maryland* 20901 (DA0D4119; DAAJ02-77-C-0052)

To analyze and correlate Army helicopter maintenance data to determine the effectiveness and impact of current Army diagnostic and condition monitoring devices, procedures, and techniques to support Army aviation maintenance.

The contractor will develop an analytical procedure for assessing the effectiveness and impact of current Army helicopter diagnostic and condition monitoring devices, procedures, and techniques. Data required for the implementation of the analytical procedure shall be identified and acquired. An assessment of the data shall be made to identify deficiencies and inaccuracies.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0018, TURBINE TIP CLEARANCE MEASUREMENT - ARMY AIRCRAFT
A.I. BELLIN, General Electric Company, *Lynn, Massachusetts* 01910 (DA0D4009; DAAJ02-75-C-0046)

The objective is to obtain realistic data including accurate tip clearance measurements for use in evaluating, validating and refining turbine tip clearance prediction techniques in order to provide the gas turbine designer with a useful tool for analyzing operating tip clearances and for designing effective tip clearance control techniques. The resulting tip clearance reductions will provide improved performance in small gas turbine engines yielding reduced fuel consumption at all engine power levels and minimizing hardware damage during engine development.

The approach will be to generate transient and steady-state data on both rotating and static components of the T-700 engine first-stage turbine during actual full-power operation, and use this data to substantiate the various rotor/shroud growth calculation techniques used in tip clearance prediction. Final comparison will be made to actual measured tip clearance which will be obtained utilizing advanced laser-optics instrumentation developed under a previous Eustis Directorate contract. The data will not only provide a basis for analytical tool refinement, but will also describe the actual real-time response of the turbine components including the hanger-type shroud typical of many Army gas turbine engines.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0019, INVESTIGATION OF A LOW-COST SERVOACTUATOR FOR HYSAS
J.H. LINDAHL, Honeywell Incorporated, *Minneapolis, Minnesota* 55413 (DA0D4108; DAAJ02-77-C-0025)

Feasibility investigation of a simple, low-cost fluid amplifier-driven spring-centered cylinder-type actuator to perform the series servoactuator function in a helicopter hydrofluidic stability augmentation system (HYSAS).

To design, fabricate, and laboratory test a simple fluid amplifier-driven servoactuator to evaluate concept feasibility. The investigation will concentrate on actuator performance parameters

considered essential for HYSAS operation and the design of an actuator to provide this performance level on a minimum cost per function basis.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Air Mobility Research & Development Lab.

1.0020, REMOTELY PILOTED VEHICLE (RPV) ACTUATOR DESIGN

J. DONIGER, Bendix Corporation, *Hackensack, New Jersey* 07608 (DA0D4092; DAAJ02-77-C-0009)

To develop lightweight, low-cost, electromechanical, rotary actuators suitable for use in both rotary and fixed-wing RPVs that weigh from 120 to 300 pounds.

To design, fabricate, and test two sizes of flight control actuators for small Army RPVs in accordance with the specifications.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Air Mobility Research & Development Lab.

1.0021, TACTICAL LANDING SYSTEM GUIDANCE TECHNIQUES

R. BORISS, U.S. Army, Avionics Laboratory, *Red Bank, New Jersey* 07703 (DA0B3400)

To develop a tactical landing system (TLS) that has (a) high potential for providing satisfactory performance in the Army's severe tactical enviroment, and (b) sufficient versatility to permit determination of guidance system parameters necessary for safe helicopter instrument approaches under tactical operational conditions.

A flexible scanning beam landing system (A-scan), subsequently called TLS, was developed which provides selectable glide slope angles, multiple localizers, variable horizontal and vertical course widths, optional DME, course softening, split or colocated siting, and altitude above touchdown. An in-house flight research program was conducted to evaluate scanning beam guidance techniques. This led to the initiation of the development of a lightweight (under 50 pounds) ku-band equipment to show contrasts among the microwave landing system, the Marine remote area approach and landing system and the Army tactical landing system philosophies.

SUPPORTED BY U.S. Dept. of Defense, Electronics Command, Avionics Lab.

1.0022, RELIABILITY AND MAINTAINABILITY

E.E. BAILEY, U.S. Natl. Aero. & Space Adm., Lewis Research Center, *Cleveland, Ohio* 44199 (DA0E3531)

Implement research and development program for improvement in the reliability and maintainability of present and future Army aircraft propulsion and drive train system components. Provide the technology for high-speed turbomachinery, transmission, and shafting, aimed at increased operational life components and materials, plus capacity for operation in varying environments.

In joint participation with NASA-Lewis Research Center, programs are formulated and executed to obtain bearings, seals, shafting, and lubrication systems with capabilities of operation for extended periods at increased speeds, temperatures, and pressures which are indicated for advanced propulsion systems. Components, based on advanced concepts, will be designed, fabricated, and evaluated under simulated operational conditions.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Air Mobility Research & Development Lab.

1.0023, WIND TUNNEL RESEARCH ON LOW-DRAG AIRFOILS FOR SHORT-HAUL AIRCRAFT

G.M. GREGOREK, Ohio State University, School of Engineering, *Columbus, Ohio* 43212 (NAS 2-9714)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

1.0024, ENGINE/AIRFRAME/DRIVE TRAIN DYNAMIC INTERFACE DOCUMENTATION

J.R. ALWANG, Boeing Company, *Philadelphia, Pennsylvania* 19142 (DA0E3773; DAAJ02-77-C-0040)

The coupled interaction between two or more helicopter dynamic subsystems has often been the source of vibration problems. This is particularly true when considering the helicopter as a dynamic system in which excitations can be generated by any or all of the propulsion system, the airframe or the drive system. The problems of vibration-related interface compatibility in engine/drive system installations are usually complicated by the inherent coupling of the three (3) major multi-degree-of-freedom systems, i.e., engine, airframe and drive train. All background data and documentation of past experience lies in the hands of the airframe/engine industry, primarily the former. The technical objective of this contractual effort is to document industry experience to the degree required to permit plans/programs to be formulated as part of an overall government effort to accumulate data which will eventually lead to a solution of generic problems of this type.

Award sole source contracts to the major manufacturers of gas turbine powered US military helicopters, to review existing files, compile reports, memoranda, analytical design efforts, etc., and coordinate with appropriate engine manufacturers.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0025, CANOPY GLINT SCREENING INVESTIGATION - ARMY HELICOPTERS

S. BLEWITT, Boeing Company, *Philadelphia, Pennsylvania* 19142 (DA0D4071; DAAJ02-76-C-0061)

Investigate helicopter canopy concepts that have the potential of eliminating/reducing the sun glint signature and internal reflections associated with current designs.

Identification and screening of promising concepts for both attack and observation helicopter applications and the fabrication, test, and evaluation of those concepts that analyses indicate are capable of satisfying the requirement.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Air Mobility Research & Development Lab.

1.0026, PRODUCT IMPROVEMENT PROGRAM EVALUATION

S.J. BLEWITT, Boeing Company, *Philadelphia, Pennsylvania* 19142 (DA0D4042; DAAJ02-76-C-0020)

The objective is to develop a procedure to allow product improvement programs to be evaluated as to their true worth. The procedure would evaluate a modification by several methods: (1) break even, (2) rate of return, (3) net present worth. The procedure would be general enough to be applicable for any system. It would allow analysis between cost and effectiveness, or implementation cost and operational cost savings. The procedure should also allow the prediction of changes in reliability, maintainability or performance caused by the various levels of resources invested in the program.

Review the best method for evaluating a product improvement program. The methodology will allow evaluation of a modification by an action-no action approach or by analyzing the differences between two modifications. The method would be system or element level sensitive. By using the procedure in conjunction with the ARMS tactical aircraft simulation model, a PIP could be evaluated over an operational period of the system.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Air Mobility Research & Development Lab.

1.0027, GUIDELINES FOR ROTOR BLADE FLAPPING LIMITS - ARMY HELICOPTERS

L.W. DOOLEY, Bell Helicopter Company, *Fort Worth, Texas* 76101 (DA0D4059; DAAJ02-76-C-0043)

Using the results of the previous contract and government recommendations, flapping design criteria for the main rotor shall be formulated. The intent shall be to present the criteria in non-mathematical terms such that they could be directly incorporated into new flying qualities and/or structural design specifications. The rationale used to develop the criteria shall be documented and may consist of some analytical justification and suggested simulation techniques which a designer could use in verifying compliance with the criteria.

Reassess the critical parameters and flight conditions as identified by the previous contract. An in-depth structural loads and response analysis of flight conditions shall be conducted for these critical parameters and flight conditions. Based upon this work, a final set of flapping design criteria will be formulated.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0028, STRUCTURES TECHNOLOGY

J.L. SHIPLEY, U.S. Natl. Aero. & Space Adm., Langley Research Center, *Hampton, Virginia* 23665 (DA0E3552)

To investigate helicopter rotor aeroelastic effects, resulting dynamic loading and vibration, maneuvering loads, and to develop analytical techniques for predicting these effects in existing and future Army aircraft. This technology is necessary to preclude the occurrence of these instabilities in flight regimes required of rotorcraft to enhance the safety, survivability, and mission effectiveness. In addition, design criteria will be developed and concepts tested which enhance rotorcraft capability without incurring dynamic limitations.

Analytical and wind tunnel investigations will be conducted of dynamically scaled bearingless and variable geometry rotors. Aeroelastic and dynamic stability investigations will be conducted to establish parameters affecting these boundaries, to develop and verify aeroelastic stability analysis, and to develop rotor math modeling capability with minimum structural mathematics simplification. Vacuum chamber tests will be initiated on a full-scale rotor blade for verification of math model dynamics.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Air Mobility Research & Development Lab.

1.0029, HT RM 75-21- ARMY HELICOPTER INTERNAL CARGO RESTRAINT EXPERIMENT

S. HOLA, U.S. Army, Air Mobility Res. & Dev. Lab., *Newport News, Virginia* 23604 (DA0D3963)

To determine the adequacy of cargo restraint criteria in a survivable helicopter crash.

Install an experimental payload in the cargo area of a CH-47B helicopter that is planned to be crash-tested at NASA-Langley. Payload and tie down devices will be instrumented and developed loads recorded. Recorded data will be analyzed. A report of the test results will be prepared.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Air Mobility Research & Development Lab.

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, INVESTIGATION OF AERODYNAMIC PHENOMENA IN POLLUTION CONTROL

L.J. SPADACCINI, United Aircraft Corporation, *Hartford, Connecticut* 06118 (68-02-1873; F624A-19)

The research program will investigate aerodynamic phenomena in the control of pollutants from gaseous and heterogeneous combustion. The program has four primary objectives: (1) To utilize recently developed optical and probing techniques to obtain detailed information on the chemical and physical processes occurring inside a combustor operating on gaseous and liquid fuels. (2) To compare experimental observations with results from a combustor flow analysis (FREP code) to further evaluate the theoretical model. (3) To further develop the combustor flow analysis for predicting the physical and chemical processes occurring in combustors operating on gaseous and liquid fuels. (4) To utilize information obtained from the experimental and theoretical investigation to evaluate potential emission control strategies for gaseous and liquid fuel combustors.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Industrial Environmental Research Lab.

3.0002, RADIATION HARDNESS OF QUARTZ

A. KAHAN, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF900510)

AF function - reconnaissance, surveillance, navigation, communications command and control. Deficiency - AF satellites require highly accurate and precise timing mechanisms to fulfill properly mission requirements. Currently used timers are susceptible to knockout major and/or spurious operation under influence of natural or man-made radiation. Objective - to specify the growth conditions for quartz crystals which, when processed into timing devices for AF systems, will be unaffected by natural radiation and which will have improved hardness in man-made radiation fields. How research contributes - this work will provide manufacturers of quartz ingots with certain processing information which will allow production of quartz of use in hardened oscillators. This information includes conditions of crystal growth, dopant type and concentration and electrical processing of the final ingot before device fabrication.

The approach is to evaluate the radiation susceptibility of quartz oscillators at a variety of radiation levels. These oscillators are produced from quartz fabricated in several specified dopant modes. After radiation exposure, resonator and oscillator measurements are made, ir spectroscopy of the material is carried out to document type and quantity of impurities present. Results are correlated with electrical sweeping preparation of samples to determine optimum sweeping parameters. Final result should yield growth and processing parameters for quartz ingots which will yield oscillators with improved frequency stability in a radiation environment.

ADDENDA: Supporting agency address is: Rome Air Development Center ETS, Griffiss AFB, N Y 13440

SUPPORTED BY U.S. Dept. of Defense, Air Force

3.0003, EVALUATION OF ADVANCED GEAR AND BEARING MATERIAL

P.J. FOPIANO, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0D4755)

The objective of this program is to investigate the metallurgical properties of new and improved case hardened gear and bearing materials used in the manufacture of high performance components for Army aircraft and armored vehicles. Of particular importance are high-speed applications as found in helicopter transmissions and high-torque applications as found in the drive train of armored vehicles. Improvements will be sought in the residual life of components by the optimization of the metallurgical structure. Program addresses itself to materials technology plan for aircraft (gears and bearings) and MTP for armored vehicles-high Hertzian stress.

Emphasis will continue to be on gear materials but bearing materials will also be considered which have the potential for continuous operation up to 450F. The effect of ingot production control parameters on structures and properties will be considered including the methods of VAR, ESR, and VIM/VAR. The optimization of metallurgical structure will be undertaken by the control of carburizing, heat treatment, and processing procedures of candidate materials. Emphasis in FY77 will be on 9310, Vasco X-2, and M50 steels in various processed conditions with possible correlations of metallurgical parameters with gear and bearing performance.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Materials & Mechanics Research Center

3.0004, COATINGS FOR UPGRADED PERFORMANCE OF GAS TURBINE ALLOYS
M. LEVY, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0B4762)

To develop improved high-temperature coatings for titanium alloys, nickel-base superalloys and columbium alloys for application in the compressor and hot turbine section of gas turbine engines in order to upgrade performance through higher turbine inlet temperatures and increases in time-between-overhaul.

To mitigate erosion-corrosion of Ti alloys between 500 and 1200F, the application of mcraly coatings which are diffusion bonded to the substrate will be explored. Evaluation will include sand erosion, fatigue, hot salt stress corrosion, and oxidation testing. Oxidation and sulfidation resistant mcraly coatings for superalloys will be further developed utilizing less costly electrophoresis and plasma spraying plus diffusion treatments. Performance in the dynamic hot corrosion test rig will be compared to current overlay coatings. Oxidation resistant diffusion coatings based on various combinations of Ti, V, Mo, and Si will be applied to Cb alloys by electrophoresis. The effects of layer composition, diffusion temperature, and coating thickness on oxidation and sulfidation resistance (isothermal and cyclic) will be evaluated.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Materials & Mechanics Research Center

3.0005, DUPLEX CERAMIC STRUCTURES - IMPROVED REACTION SINTERED SILICON NITRIDE
D.R. MESSIER, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0C4794)

The objective of this program is the development of improved reaction sintered silicon nitride materials for future Army propulsion and/or power generation applications including stationary hot flow path components such as stators and shrouds. The program applies to pacing materials problems in aircraft (turbine components 14.2, 15.2, 15.7, 15.11 in FY76 guidance), armored vehicles (combustor, power turbine, and regenerator for 1370 degrees C TIT as well as problems in surface mobility, craft and missile materials. The major thrust is cost reduction via fuel economy.

Work on the infiltration process for forming dense coating on porous silicon nitride will be continued. Parameters for producing silicon coatings will be optimized, and further attention will then be given to nitridation of the coatings to form dense silicon nitride surface layers. Evaluation criteria will include oxidation resistance, fracture behavior, and mechanical strength.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Materials & Mechanics Research Center

3.0006, CHEMICAL CHARACTERIZATION OF SILICON NITRIDE
H.F. PRIEST, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0A4752)

The technical objective is twofold: to determine the impurities present in silicon nitride prepared in a variety of ways, these impurities interact with each other and with the matrix and how silicon nitride can be prepared free of degrading impurities; to develop rapid, nondestructive 14 MeV neutron and/or high-energy photon activation analysis techniques relevant to the characterization of silicon nitride.

The emphasis will be on silicon nitride for ceramic engine application where the major technical barriers are obtaining starting materials of sufficient purity, producing materials of known composition, theoretical density and sufficient strength, and characterizing the materials and evaluating all parameters to determine if the needed quantum jumps in properties can be obtained. The unique AMMRC 14 MeV activation analysis system will be used to study the oxidation mechanism of silicon nitride and 'sialon'. The chemistry of densification of silicon nitride by pressure sintering as well as hot pressing will be studied in order to optimize the method of preparation. Mass spectrometry, and infrared will be used in this research, which will be carried out at AMMRC, to help characterize the reactions and products.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Materials & Mechanics Research Center

3.0007, PREVENTION AND PREDICTION OF ENVIRONMENTAL DETERIORATION OF ORGANIC MATERIALS
R.E. SACHER, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0D4815)

The goals of this program are to determine and correlate the extent and severity of critical chemical, mechanical and physical property changes in exposed composite materials, in order to provide effective methods of prediction and prevention of environmental deterioration of these materials in Army material. Major program thrust - aircraft survivability.

Relevant glass, kevlar, hybrid, carbon and metal based organic composites will be simultaneously characterized and subjected to environmental effects at selected field sites, natural and accelerated, and in laboratory apparatus. These samples will be exposed in material, stressed, stabilized and coated configurations to simulate actual field use. Post-exposure mechanical, physical and chemical changes will be monitored by techniques developed to follow degradation phenomena. The prediction of the life-time of a material will be generated for each system at the earliest possible time or by at least a factor of ten. The effects of moisture or composites will be studied extensively. The exposure work will continue on the compounded polyphosphazenes, polyethane and coated and uncoated polycarbonates. Also, novel techniques developed for monitoring deterioration will be assessed by NDT methods.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Materials & Mechanics Research Center

3.0008, DEVELOPMENT OF NEW FIRE-RESISTANT POLYMERS
R.E. SINGLER, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0D4697)

To develop high-strength, chemically resistant, thermally stable polymers with a phosphorus-nitrogen backbone which will be evaluated for use in nonflammable coatings, foams and insulation, hydraulic fluids, and other applications. Major thrust - survivability, night operations, aircraft and combat vehicles.

Exploratory synthesis will be continued in the area of poly (aryloxy and aminophosphazene) copolymers. Chemical modifications will be studied in attempts to prepare phosphazene terpolymers, suitable for crosslinking, and cyclolinear polyhosphazenes. These polymers will be investigated for both closed-cell and open-cell foam applications. Polymerization conditions will be manipulated in order to prepare phosphazene oligomers as fire-resistant hydraulic fluids. The thermal mechanical behavior and morphology of these polymers will be investigated to determine structure-property relationships for the polyphosphazenes. The large-scale laboratory synthetic effort will be continued to provide sufficient quantities of polymers for laboratory processing studies and long-term environmental deterioration studies.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Materials & Mechanics Research Center

3.0009, COAL INTERFACE DETECTION
D.A. SUMMERS, Univ. of Missouri, School of Mines & Metallurgy, *Rolla, Missouri* 65401 (NSG 8055)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, THE LARGE-SCALE INTEGRATED CIRCUITS PROCESS TECHNOLOGY
D.V. KERNS, Auburn University, School of Engineering, *Auburn, Alabama* 36830 (NAS 8-32634)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0002, DYNAMIC SIMULATION OF TRUCK/AIR CARGO MODAL SPLIT
J.S. DAJANI, Stanford University, Graduate School, *Palo Alto, California* 94305 (NCA 2-745720)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0003, EQUIPMENT FOR COMBUSTION AND MOLECULAR BEAM RESEARCH
D.R. MILLER, Univ. of California, School of Engineering, *San Diego, California* 92038 (ENG77-16989)

A tunable laser source and accessory equipment are provided to assist in research on combustion and molecular beam studies; of particular interest is the laser-induced fluorescence technique which permits simultaneous concentration and temperature measurements at a well defined point. The combustion group will use the measurements to monitor concentration profiles of radicals, especially OH, in diffusion flames. The molecular beam group will apply the technique to study internal excitation of molecular products produced in molecular beam experiments and to study relaxation of internal energy states in supersonic expansions.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0004, WAKE VORTEX TURBULENCE STUDY USING RADIO-CONTROLLED MODELS
D.R. SANDLIN, Calif. State Univ. & Colleges, School of Engineering, *San Luis Obispo, California* 93401 (NSG 4014)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0005, PERMANENT MAGNET HIGH-POWER MICROWAVE TUBES
W. HARMAN, Hughes Aircraft Company, *Torrance, California* 90509 (DF741360; F30602-77-C-0109)

The objective of this effort is to eliminate the electromagnetics required to focus linear beams operating in excess of 100 kw peak power. The Air Force is charged with the detection, identification and tracking of vehicles in the earth's atmosphere and in space for both tactical and strategic defense. This function must be achieved with the minimum life cycle cost. The high-power transmitters in Air Force radars currently employ linear beam microwave amplifiers (Klystrons, TWTs) that require external electromagnetics that: 1) are costly, 2) consume prime power, 3) are heavy, 4) add to system complexity and logistical support problems.

Rare-earth magnetics such as samarium cobalt produce high magnetic fields and can now be produced at a reasonable cost. This effort will study the replacement of the electromagnets with S5Co17 to achieve a 10 to 1 weight reduction, a 5 to 1 cost reduction, and a total operating efficiency improvement.

ADDENDA: Supporting agency address is: Rome Air Development Center OCT, Griffiss AFB, N Y 13440

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0006, JRO SATELLITE MEASUREMENTS
B.B. BALSLEY, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (RDJ46258)

PROJECT OBJECTIVE: Conduct a program of satellite cross-section measurements using the Jicamarca Radar facility.

CURRENT YEAR PLAN: Operate Jicamarca Radar facility during period of satellite passes. Continue analysis of data and precise determination of system losses in order to obtain an accurate estimate of the satellite cross section.

PROGRESS REPORT: Data were obtained for a series of satellite passes of Jicamarca Radar Observatory. Preliminary analysis of the data was performed at JRO.

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0007, WIND SHEAR - RADAR EFFORT
R. STRAUCH, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (RAA79266)

PROJECT OBJECTIVE: 1. Determine the effects of antenna beamwidth and offset of the radar beam from the glide slope on wind profiles measured by radar. 2. Add capability of detecting winds in the clear air to existing FPS-18 radar at NAFEC test site. 3. Assist NAFEC in establishing experimental program and evaluating data.

CURRENT YEAR PLAN: Complete FAA demonstration radar for all-weather wind shear detection system.

PROGRESS REPORT: Specifications for antenna completed. Hardware and software for Doppler data processing completed. Report completed on simulation of shear detection for various radar geometrics.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin., Systems Research & Development Service

4.0008, VIRTUAL IMAGE DISPLAY DEVICE
G. ROSENDAHL, U.S. Navy, Physical Sciences Laboratory, *Orlando, Florida* 32813 (DA0M4995)

An efficient, lightweight, compact, low-cost virtual image display device is needed for future flight trainers and vehicle crew trainers. This device should meet tri-service requirements with specific US Army applications in synthetic flight trainers and tank driver simulators.

The approach is to design and breadboard a system of fresnel lenses on thin plastic plates with refractive indices suited for chromatic correction. Following appropriate testing, a specification will be prepared for future visual system procurements.

ADDENDA: Supporting agency address is: DARCOM Project Manager for Training Devices, Naval Training Equipment Center, Orlando, FL 32813

SUPPORTED BY U.S. Dept. of Defense, Army

4.0009, DEVELOPMENT OF FAULT-TOLERANT MICROPROCESSOR-BASED COMPUTER SYSTEMS FOR SPACE FLIGHT
V.T. MONTGOMERY, Southern Univ. A & M College, School of Engineering, *Baton Rouge, Louisiana* 70813 (NSG 8053)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0010, GEOMETRICAL METHODS FOR NONLINEAR DYNAMICS
R.W. BROCKETT, Harvard University, School of Arts & Sciences, *Cambridge, Massachusetts* 02138 (NSG 2265)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0011, DIFFERENTIAL ABSORPTION LASER SYSTEMS
R.T. THOMPSON, U.S. Environ. Protection Agcy., Remote Sensing Division, *Las Vegas, Nevada* 89114 (J620A-39)

OBJECTIVES: To design, construct and interpret data from airborne nadir-viewing, laser differential-absorption systems. A CO2 laser system will be developed to measure ozone. A frequency-doubled dye laser system (approximately 300nm) will be developed to monitor sulfur dioxide. The use of differential absorption systems to monitor selected tracer gases will be investigated.

APPROACH: The systems each consist of two lasers, the wavelengths of which have been selected to optimize the difference in reflected signal due to the wavelength dependence of the pollutant or tracer gas. A computer code has been developed to simulate data tapes using a model atmosphere. Simulations are used to develop interpretive software and analyze system parameters. Design consideration preclude the possibility of endangering people with laser radiation.

CURRENT PLANS: The ozone monitor system is being redesigned due to laser failure and incompatibility determined in ground tests and preliminary flight tests. The ozone system will be flight tested during 1978 with operational flights to follow. Laboratory studies on the feasibility of using tracer gases have been completed. The SO2 monitor system will be designed in 1978 with procurement and construction to occur in the following 12 months.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Support Lab.

4.0012, SPARK IGNITION OF LIQUID FUEL SPRAYS
C.E. POLYMEROPOULOS , Rutgers The State University, School of Engineering, *New Brunswick, New Jersey* 08903 (ENG76-15603)

The research covers an experimental study of the minimum spark ignition energy of liquid fuel sprays. The study will examine fundamental parameters, and will employ primarily monodisperse sprays and laminar flow. The effect of droplet size, air-fuel ratio, and flow velocity on minimum spark ignition energy will be assessed. Holographic observations of the expanding spark kernel will furnish information on the effect of kernel development on particle concentration. Existing methods for the estimation of the fraction of spark energy that is useful for ignition will be employed. The critical spark and mixture conditions for ignition will be correlated using available heat balance models at the critical kernel size, adapted for the presence of droplets.

Monodisperse tetralin sprays will be employed to identify the quenching distance as a function of droplet diameter for a range of flow velocities and air-fuel ratios. The spark discharge time will be optimized in terms of obtaining the smallest ignition energy for each droplet size. The effect of the expanding spark kernel on the distribution of droplets around the igniter will be assessed using high-speed holography. Finally, measurements of minimum spark energy for ignition obtained using polydisperse sprays will be carried out, and the results will be interpreted in terms of the monodisperse spray results. To aid the interpretation and presentation of experimental data, existing concepts of the thermal balance at the critical kernel size, which were developed for homogeneous mixtures, will be employed for deriving similar relations for heterogeneous mixtures. In addition, the fraction of spark energy useful for ignition will be estimated.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0013, ADVANCED AVIONIC SYSTEMS ANALYSIS
L. YOUNGBLOOD, U.S. Army, Avionics Laboratory, *Red Bank, New Jersey* 07703 (DA0C3431)

Development of the software necessary for integration of advanced tactical avionics systems and participation in development of government/industry systems integration standards.

To participate in triservice/industry efforts to develop standards for advanced tactical avionic systems (these include standards for avionic software and multiplex hardware). To apply existing software operating systems (e.g. SKC-2000 assembly language, INTEL 8080 assembly language) to the design of software addressing current Army exploratory development problems. To perform the systems analysis necessary to support these efforts.

SUPPORTED BY U.S. Dept. of Defense, Army, Electronics Command

4.0014, DIGITAL/MODULAR AVIONICS
L.J. YOUNGBLOOD, U.S. Army, Avionics Laboratory, *Red Bank, New Jersey* 07703 (DA0D2810)

The objective of this task is to design and breadboard a core Army avionics system using digital integration techniques. This type of system will provide the Army pilot with a capability which will simplify his workload by giving him a central control panel, and a general-purpose display. In addition, it will provide the flexibility to add or delete from the aircraft configuration with redesign or modification of the basic aircraft installation.

A basic set of Army avionics equipment, including communications, navigation, and identification subsystems, will be selected for bench integration over a digital data bus system. A single keyboard-type control box will be developed to control all subsystems, and a general-purpose display will also be developed. Following the bench-test phase, the equipment will be installed on a test-bed aircraft for flight tests.

SUPPORTED BY U.S. Dept. of Defense, Electronics Command, Avionics Lab.

4.0015, STUDY TO TEST AND EVALUATE RESIDUAL SEASAT HARDWARE FOR POSSIBLE IMPLEMENTATION FOR THE OFT-2 SAR ANTENNA
D.G. HENRY, New Mexico State University, Graduate School, *Las Cruces, New Mexico* 88001 (NAS 9-95482)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0016, PROTOTYPE CEILING AND VISIBILITY SENSOR
R.S. BONNER, U.S. Army, Atmospheric Sciences Lab., *Las Cruces, New Mexico* 88002 (DA0D2293)

To provide a low-cost, portable ceiling and visibility sensor to support U.S. Army low-flying, close-support fixed- and rotary-wing aircraft and artillery operations as required.

Design and fabricate an experimental development model portable ceiling and visibility sensor using lidar technology and evaluate its capability.

SUPPORTED BY U.S. Dept. of Defense, Electronics Command, Atmospheric Sciences Lab.

4.0017, AUTONOMOUS CONTROL OF ROVING VEHICLES FOR UNMANNED EXPLORATION OF THE PLANETS
S.W. YERAZUNIS, Rensselaer Polytechnic Inst., School of Engineering, *Troy, New York* 12181 (NSG 7369)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0018, WIND TUNNEL SIMULATION AND CONTROL
G.P. GUMAS, Penn. State University, Graduate School, *University Park, Pennsylvania* 16802 (NSG 1457)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0019, HT 74-14- BALLISTIC TESTING, ARMY AIRCREW AND CRITICAL COMPONENT PROTECTIVE DEVICES
C.M. PEDRIANI, U.S. Army, Air Mobility Res. & Dev. Lab., *Newport News, Virginia* 23604 (DA0D3912)

To provide ballistic testing of critical component and aircrew protective devices and to validate design criteria that increase the ballistic survivability of Army aircraft.

To conduct experimental firing programs in conjunction with design, fabrication, and ballistic test to evaluate: 1) fuel fog inerting concepts to reduce inflight fuel fires in helicopter, 2) fuel tank materials to increase the survivability of the AH-1G to 14.5mm API projectiles, 3) fuel tank materials to increase the survivability of the AH-1G to 23mm HEI projectiles, 4) ballistic tolerant drive shafts/aircrew transparent and opaque armor upgrade, 5) support of other area missions, e.g., aircraft structures and flight controls, 6) miscellaneous support, e.g., installation, test, and evaluation UTTAS and HLH.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Air Mobility Research & Development Lab.

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, CORONAL PLASMA STRUCTURES
G. VANHOVEN, Univ. of California, School of Physical Sciences, *Irvine, California* 92664 (NSG 7375)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0002, A STUDY OF REGIONS OF DETACHED PLASMA IN THE OUTER MAGNETOSPHERE
M.G. KIVELSON, Univ. of California, Inst. of Geophys. & Pla. Phys., *Los Angeles, California* 90024 (ATM74-23464 A01)

This grant will support an investigation into a number of important magnetospheric processes including: the coupling of the solar wind-magnetosphere-ionosphere system through the resonant properties of the magnetospheric cavity; the interaction and exchange of energy between waves and particles in the magnetosphere and the role of resonant particles in the interaction; and the injection and redistribution of plasma within the magnetosphere produced by large-scale (convection) electric fields.

The diverse objectives are unified by the fact that the primary data base for the analysis is formed by measurements obtained from a number of OGO-5 spacecraft instruments, of which the most important for the present work are the Lockheed Light Ion Mass Spectrometer and the UCLA Fluxgate Magnetometer. All relevant data are available or can be readily obtained on request. Initial phases of the investigation have shown that the data is capable of providing unique in-situ measurements of properties of ULF waves in the magnetosphere while simultaneously giving indications of probable generation and amplification processes.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0003, REMOTE SENSING OF PHYTOPLANKTON - REFLECTANCE SPECTROSCOPY OF MARINE BACTERIA AND COLLOIDS
D.A. KIEFER, Univ. of Southern California, School of Letters Arts & Sci., *Los Angeles, California* 90007 (7-717; 04-7-158-44123)

OBJECTIVE: To further the understanding of the remotely-sensed spectral signature of the ocean by determining the importance of marine bacteria and colloids to ocean color spectra, and to test the adequacy of the two-component model of ocean color.

APPROACH: The relationship between the diffuse spectral reflectance of the ocean and the presence of marine bacteria and colloids will be examined by applying the principles of reflectance spectroscopy. In particular, the absorption and backscattering coefficients for common marine bacteria (0.2-1.0 micron) and isolated marine colloids (0.01-0.2 micron) will be determined. The bacteria will either be laboratory-grown or concentrated by differential filtration from samples of California coastal waters. The colloids will be concentrated by ultrafiltration methods from similar samples.

PROGRESS: A simple model of ocean color now exists in which the only optical components of the water are phytoplankton and clear sea water. Numerous studies of sea water samples have indicated that dissolved and suspended natural material smaller than phytoplankton may contribute to the ocean color spectra.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0004, MESOSCALE ATMOSPHERIC EVENTS - ANTARCTICA
R.J. RENARD, U.S. Navy, Meteorology Department, *Monterey, California* 93940 (DPP76-80165)

Meteorological data obtained by satellites, automatic weather stations, and conventional means in the vicinity of McMurdo, Antarctica, during the austral summer period will be analyzed to determine the relationship between mesoscale atmospheric events and synoptic-scale circulations. The objective for the first year is to identify the meso-synoptic-scale processes relating to operationally significant weather in the McMurdo area. The longer-term goal is to model mesoscale systems associated with significant weather producing synoptic-scale circulations over a permanent ice/snow-covered region of variable elevation.

Dr. Renard plans to do field work near McMurdo in austral summer 1977/78 and 1978/79.

SUPPORTED BY U.S. National Science Foundation, Div. of Polar Programs

5.0005, STUDIES OF MAGNETOSPHERE-IONOSPHERE-ATMOSPHERE INTERACTIONS
R.A. HELLIWELL, Stanford University, School of Engineering, *Palo Alto, California* 94305 (ATM74-20084 A02)

This grant will support investigations into several aspects of magnetosphere-ionosphere-atmosphere coupling. The research includes both data analysis and theoretical work. VLF data form Stanford University's experimental programs at Siple, Antarctica, and Roberval, Quebec, will be used to study the thermal plasma dynamics and wave-particle interactions in the magnetosphere. The results will be compared with energetic particles and thermal plasma data from various ground-based instruments including incoherent scatter radars, HF sounders, photometers, etc. Atmospheric electric field data from the polar cap regions acquired through cooperative programs with other institutions will also be studied. Theoretical work will be aimed at modeling magnetosphere-ionosphere-atmosphere coupling through particle and heat fluxes and through electric fields. Specific topics to be investigated include: (1) thermal plasma distribution and flow along magnetic field lines; (2) substorm electric fields and their effects on the plasmasphere-ionosphere system; (3) correlative studies of plasmapause-associated phenomena including generation of VLF and ULF waves, particle precipitation, and ionospheric troughs; (4) artifically induced precipitation of energetic electrons; (5) theoretical studies of electrical coupling between the magnetosphere, ionosphere and lower atmosphere; (6) model studies of controlled modification of the ionosphere and plasmasphere through particle precipitation, chemical release, and F-region heating; and (7) analysis of atmospheric electric field data from polar cap regions.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0006, DETERMINATION OF SO2 MASS EMISSION RATES BY REMOTE SENSING
R.B. SPERLING, Environmental Measure. Inc., *San Francisco, California* 94111 (68-02-2711; G712B-BA-59)

The project objective is to determine the relative accuracy of remotely measured SO2 mass emission rates from a power generating station with respect to standard reference methods. Under a preceding contract, two types of remote sensing air quality instruments (spectrometers) were used to measure fence-line vertically integrated burdens of SO2. Concurrent wind velocity measurements were made by means of a laser Doppler velocimeter, a tethersonde and pilot balloon. The current contract will provide two stages of data evaluation: data processing and data analysis. The SO2 mass emission rates will be calculated from the SO2 and wind data. Comparisons of these results will be made with in-stack and cross-stack results. An analysis will be made of the effect on accuracy made by each wind measuring system.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0007, MASS AND ENERGY TRANSPORT BY INTERNAL GRAVITY WAVES

A. MILLER, Calif. State Univ. & Colleges, School of Science, *San Jose, California* 95114 (ATM77-12246)

Previous results have demonstrated a significant vertical transport of mass and energy across stable atmospheric layers in the San Francisco, Pacific Ocean region. This research will attempt to quantify this transport, to verify the physical model that has been suggested and to formulate these fluxes in terms of commonly measured atmospheric quantities. The instrumented Mt. Sutro Tower, along with aircraft, and an ocean vessel, will be used to obtain the measurements.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0008, ATMOSPHERIC SCATTER STUDIES

B.B. BALSLEY, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (8DJ42853)

PROJECT OBJECTIVE: To investigate various parameters of the Atmosphere/Ionosphere system that can be examined by radar techniques.

CURRENT YEAR PLAN: Typical investigations include studies of neutral winds in the height range 10-100 km and ionospheric effects due to underlying orographic features (e.g. mountain lee waves). Also included are studies using the large incoherent scatter radar facilities at Chatanika (Alaska), Arecibo (Puerto Rico), and Jicamarca (Peru).

PROGRESS REPORT: Analysis of equatorial neutral wind and temperature data in equatorial regions at heights greater than 100 km show pronounced effects due almost certainly to the Andean Cordillera. This result implies that the entire stratosphere-mesosphere system can be strongly affected by underlying features (mountain ranges, large-scale weather systems, etc.). Additional data show that VHF radars can be used to examine the atmosphere in the complete height range 1-100 km. Comparisons between radar wind data and rawinsondes in Puerto Rico and Alaska show that these radars can accurately measure the wind.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs.

5.0009, HF SEA SCATTER ANALYSES

D. BARRICK, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (8AA71050)

PROJECT OBJECTIVE: To establish accuracy and utility of HF skywave radar for wide-area sea-state monitoring.

CURRENT YEAR PLAN: 1. Complete development of models for ionospheric contamination. 2. Optimize radar parameters (based on contamination model and operating experience). 3. Propagation management (using real-time ionospheric diagnostics). 4. Signal processing for path contamination removal. 5. Completion of collection of measured data base.

PROGRESS REPORT: 1. New team established (WPL & SRI). 2. Large data base collected. 3. Spectral quality vs. angular resolution established. 4. Waveheight comparisons made (radar vs. EB-20). 5. Hurricanes Anita and Babe observed/tracked. 6. Interactive graphics tool developed. 7. Discrete multipath removal successful.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs.

5.0010, SEA CURRENT RADAR

D. BARRICK, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (8AA73157)

PROJECT OBJECTIVE: a) To develop, demonstrate, and perfect transportable HF radar systems for the measurements of coastal surface currents. b) To apply this new remote sensing tool to oceanographic investigations.

CURRENT YEAR PLAN: a) To continue improvements to the radar hardware and software. b) To isolate and estimate error sources in the system. c) To interpret and publish the Alaskan data on currents in the Cook Inlet.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs.

5.0011, ADVANCED TECHNIQUES

R.J. DOVIAK, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (8C370403)

PROJECT OBJECTIVE: To develop suitable Doppler radar and other mesoscale observational equipment and to use it to produce improved descriptions of severe storm circulations. To develop Doppler radar techniques toward the eventual implementation of Doppler radar as an operational radar suitable for application in NWS. To develop techniques and equipment for atmospheric electricity measurements. The electrical measurements to be correlated with other meteorological information including precipitation and wind flow data from Doppler radars.

CURRENT YEAR PLAN: The pulse Doppler radars will be modified to permit increased data acquisition flexibility. The Cimarron system will be modified for the dual PRF scheme and both Cimarron and Normam will be modified to accommodate a selectable PRF. A ground clutter filter will be designed, fabricated and tested. This filter will minimize ground clutter bias in pulse pair estimates of meteorological target velocities. The Norman facility color display terminal will be modified and expanded to allow greater flexibility and speed of data handling.

Atmospheric electric measurements will be made on severe and tornadic storms. Participation could include, but is not limited to, the study of electrical parameters near tornadoes by use of portable instrumentation, remote sensing of electrical clouds using microwave radiometers, lightning characteristics of severe storms, and cornea discharge. The electrical measurements will be correlated with other existing meteorological information, including precipitation and flow data from Doppler radar.

Spherics direction finding equipment will be used to measure the azimuth and elevation angles to lightning discharge processes in thunderstorms for severe storm research. Experiments so far indicate that lightning elements can be located to an accuracy of a few hundred meters at rates of up to 25,000 per second using wide-band VHF receiving techniques. These and other studies will be used to document the electrical characteristics of severe and tornadic storms and will provide inputs in the modeling of these storms.

PROGRESS REPORT: On-line pulse-pair processors were modified to permit increased data acquisition rate. Electronic circuitry was added to provide for more flexible data acquisition schemes. The pulse Doppler radars were configured to allow sensitivity necessary to detect clear air motions. (Text abridged.)

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs.

5.0012, DATA ACQUISITION

C.E. HORNBACK, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (8DJ22960)

The Real-Time Data Service provides data collection and research facilities at Table Mountain, Colorado, and Anchorage, Alaska, for monitoring satellite and ground-based geophysical sensors. The data are used to support the Space Environment Services of SEL and the AF AWS.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs.

5.0013, BAO OPERATIONS

J.C. KAIMAL, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (8AA72772)

PROJECT OBJECTIVE: To acquire, process, and record turbulence and profile data from the first 300 m of the atmosphere for remote sensing research and for studies of atmospheric turbulence and diffusion.

CURRENT YEAR PLAN: 1. To collect data for software development, evaluation of site characteristics and studies of boundary layer growth. 2. To interface sensor circuits to the multiuser data acquisition systems at the BAO site.

PROGRESS REPORT: Tower installation completed. Fast response instrumentation for the tower developed.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs.

5.0014, RADIOMETER CONSTRUCTION

P. KUHN, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (8G13 0817)

PROJECT OBJECTIVE: Design, construct, test and install in research aircraft, solar net radiometer and sea scanning surface temperature radiometer.

CURRENT YEAR PLAN: Begin design of instruments, purchase parts and let contract for construction work.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs.

5.0015, RESEARCH IN AIR POLLUTION METEOROLOGY

L.E. NIEMEYER, U.S. Dept. of Commerce, Meteorology Laboratory, *Boulder, Colorado* 80302 (D7-0305; G603A-AB-01)

The research effort includes the continuing development, evaluation, and validation of air quality simulation models, both for inert and reactive pollutants. Users will be provided access to these models through the EPA User's Network for the Applied Modeling of Air Pollution (UNAMAP). New concepts and technologies will be developed and adapted for improving the weakest components of existing models, with emphasis on the effects of topography, pollutant removal and conversion processes, and complex sources. Other activities will be directed toward the determination and definition of the effects of pollutant emissions on visibility, weather, and climate. Further studies will be conducted in air pollution potential climatology.

Participation will continue in the Regional Air Pollution Study (RAPS). The field portion of the study will terminate in Spring, 1977, and analysis and use of the data for model evaluation and verification will be initiated.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0016, ATMOSPHERIC STUDIES

T.E. VANZANDT, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (8DJ41451)

PROJECT OBJECTIVE: Study of atmospheric physics, particularly the dynamics of the atmosphere from the troposphere up to the iono-thermosphere (approximately 100 km), using data from sensitive Doppler radars.

CURRENT YEAR PLAN: Observational and theoretical study of bouyancy (acoustic-gravity) waves in the troposphere and lower stratosphere, using velocity fluctuation observations from the Sunset Radar. Study of turbulence and turbulent transport in the atmosphere, particularly in the troposphere and lower stratosphere.

PROGRESS REPORT: A model for calculation of profiles of structure constant from rawinsonde data has been developed.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs.

5.0017, THE GENERATION AND USE OF CIRRUS CLOUDS AS A TOOL FOR WEATHER MODIFICATION

W.M. GRAY, Colorado State University, School of Engineering, *Fort Collins, Colorado* 80521 (ENV77-10229)

The objective of this research is to explore the feasibility of artificially generating cirrus clouds, to numerically model and observe the influence of cirrus on mesoscale weather, and to study the amount and diurnal variation of natural cirrus clouds to determine whether mesoscale weather modification by artifically produced cirrus is feasible.

The effort consists of an observational research program utilizing infrared data from satellites, data from the Global Atmospheric Research Program Atlantic Tropical Experiment and from the Northwest Pacific, and cirrus cloud versus surface temperature data over the United States. The second portion of the study consists of numerical modeling the effects of cirrus on the troposphere and mesoscale weather using two-and three-dimensional models currently in operation. Possible means of producing cirrus clouds include seeding saturated layers of the upper atmosphere, jet aircraft condensation trails positioned so as to spread throughout cold moist layers of the upper atmosphere, or injecting carbon black into the atmosphere with the heating resulting from solar energy absorption producing the cirrus.

Utilization activities include widespread dissemination of the results to the potential user community, such as various governmental agencies (both Federal and state), commercial cloud seeders, agricultural groups and others.

SUPPORTED BY U.S. National Science Foundation, Div. of Advanced Environmental Research & Technology

5.0018, DEVELOPMENT OF LASER TECHNIQUES FOR ATMOSPHERIC SENSING 11876-GS

C.Y. SHE, Colorado State University, School of Natural Sciences, *Fort Collins, Colorado* 80521 (DA0D9284; DAAG29 76 G0148)

To develop new techniques for determining atmospheric motions. This capability is the highest priority in the atmospheric sciences laboratory program for developing an automated meteorological system; it would make possible substantial improvement in artillery accuracy. In a longer range view, the research may also lead to remote sensing of turbulence, temperature, humidity, and particulate concentration and size, and be important to a number of military concerns, including microwave communications, laser systems used in the ambient atmosphere and prediction of mesoscale weather. Three Army laboratories have programs which will benefit from this work.

An experimental and theoretical program will be conducted to investigate and develop the technique of laser cross-beam-photon-correlation spectroscopy for the remote measurement of both laminar and turbulent flows under different temperature and moisture conditions. After successful completion of the laboratory work, field testing from the laboratory will be conducted and, if warranted, an airborne system will be constructed.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Army Research Office

5.0019, USE OF METEOROLOGICAL SATELLITE DATA IN THE TROPICS

T.H. VONDERHAAR, Colorado State University, School of Engineering, *Fort Collins, Colorado* 80521 (ATM76-82697)

The objectives of this research continue to be: (1) the determination of the energetics of the tropical earth atmosphere system, (2) the study of radiational properties of tropical clouds, and (3) the study of organized tropical oceanic convection.

The data to be used to achieve these objectives are from four satellites: the Nimbus-5, SMS-1, NOAA-3 and the METEOR. These data will be analyzed for the Global Atmospheric Research Program (GARP) Atlantic Tropical Experiment (GATE) region in the eastern tropical Atlantic.

The scientific goal of the first objective is to obtain the most complete and accurate data set of the radiation/energy budget that has ever been obtained over tropical regions. This set will serve as a basic GATE data set available to others in the meteorological community. The second objective addresses the problem of classifying the bi-directional reflectance of tropical clouds as a function of sun-cloud geometry, size, and cloud top temperature. This approach has useful application for monitoring geosynchrous satellite measurements for regional heat budgets. The third objective has as its goal the determination of the initiation, growth, and maintenance of tropical convective systems.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0020, THE EL NINO CYCLE
C.S. RAMAGE, Univ. of Hawaii, School of Arts & Sciences, *Honolulu, Hawaii* 96822

The objective of this research is understanding of the connection between the atmosphere and the El Nino cycle. Atmospheric data will be acquired and analyzed to provide lateral heat and momentum transports and to provide patterns of wind stress and vertical ocean-atmosphere heat exchange. Estimates of open-ocean rainfall will be made from satellite infrared cloud photographs.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0021, DEVELOP AN OPERATIONAL FOREST RESOURCE INFORMATION SYSTEM
R. MROCZYNSKI, Purdue University, Graduate School, *Lafayette, Indiana* 47907 (NAS 9-15325)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0022, FALLOUT WINDS FROM SATELLITE RADIANCE OBSERVATIONS
G. OHRING, Tel Aviv University, *Tel Aviv, Israel* (DA0D9338; DAERO 77 G0051)

The major purpose of the proposed research program is to develop and test techniques for inferring effective fallout winds directly from mix of satellite radiance and conventional (radiosonde) observations.

The proposed technique should enable a simple, quick, direct transformation of the satellite radiance observations to effective fallout wind. The research will test and validate the technique on the sets of satellite and conventional (radiosonde) data available for White Sands Missile Range before testing the technique on field operational satellite and conventional observations.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Research & Standardization Group

5.0023, MULTIDISCIPLINARY RESEARCH PROGRAM IN ATMOSPHERIC SCIENCE
O.E. THOMPSON, Univ. of Maryland, School of Engineering, *College Park, Maryland* 20740 (NSG 5209)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0024, ENVIRONMENTAL SAFETY RISK ASSESSMENT SUPPORT
R.W. ENGLEHART, N U S Corporation, *Rockville, Maryland* 20850 (EN-77-C-02-4290)

The contract work involves the performance of specialized environmental safety and risk assessment support for the Energy Research and Development Administration (ERDA), Division of Nuclear Research and Applications, in the areas of: safety reviews of radioisotopic power systems; safety, biological, and environmental risk assessment of specific applications of radioisotopes; behavior of radioisotopes in the environment; meterological support of launches of space vehicles carrying radioisotopic power systems; and special ad hoc consulting and analyses.

The overall objective of this contract is to provide ERDA with an independent capability for evaluating safety criteria, performing radiological safety and risk assessments, and safety support for the use of radioisotopes for power generation in special applications.

In the conduct of this work NUS has developed and applied computational models for risk assessment, including dispersion analyses, pathway analyses, radiological dose modeling, etc., as well as the expertise of the individuals performing the work.

RESULTS: NUS has performed the type of work described since 1962 and has received a new contract to continue through 1979.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Nuclear Research & Application

5.0025, INVESTIGATION OF THE UPPER ATMOSPHERE USING DATA FROM AE SATELLITES
M.B. MCELROY, Harvard University, School of Arts & Sciences, *Cambridge, Massachusetts* 02138 (NAS 5-24134)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0026, STUDIES OF IMAGES OF SHORT-LIVED EVENTS USING ERTS DATA
W.A. DEUTSCHMAN, Smithsonian Institution, *Cambridge, Massachusetts* 02138 (NAS-5-21858)

The object of this program was to determine the feasibility of observing short-lived events with the ERTS satellite and to establish event-detection criteria applicable to different categories of events. Of the 222 events we evaluated, we decided that 53 of them might be detected by the ERTS sensors. Nineteen were subsequently photographed by ERTS and studied by us. We concluded from this program that ERTS photographs are a useful and economical way for individual investigators to obtain data about short-lived events. Larger events can be detected on the photographs without knowledge of their exact location. If the general area is known and which event (e.g., a remote volcano, flood, or vegetation change) is expected to occur, the ERTS photograph can be used to determine if it actually did occur. Small-sized events can be studied if their location is known. Furthermore, from images of the events, we have received useful scientific data that cannot otherwise be easily obtained.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

5.0027, CLADOPHORA MEASUREMENTS USING REMOTE SENSING
C.T. WEZERNAK, Environmental Res. Inst. Mich., *Ann Arbor, Michigan* 48107 (R803611; N608A-19)

The objectives of the project are to develop and/or demonstrate remote sensing techniques for mapping Cladophora using passive multispectral scanner data collected from low aircraft altitudes, and to define the capability of passive multispectral remote sensing for estimating Cladophora biomass.

Remote sensing and supporting field data will be collected during June 1975 over a 5 km study area along the shoreline of Lake Ontario at a location near Rochester, New York. Processing of multispectral scanner data will include both analog and digital techniques to show the distribution of Cladophora and to relate spectral characteristics to standing crop.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Research Lab.

5.0028, THE EFFECT OF COUNTRY DRAINAGE DITCHES ON WATER QUALITY AND QUANTITY IN SOUTH CENTRAL MINNESOTA
H.W. QUADE, Mankato State University, School of Arts & Sciences, *Mankato, Minnesota* 56001 (A-040-MINN)

The proposed research plan involves field investigations followed by modeling and computer simulation of water quality as affected by an extensive country drainage ditch system related to agricultural land-use practices.

The first year would involve the following investigations which would aid in site selection for the second year as well as simulation and modeling in the third year. 1) Qualitative physiographic drainage analysis of the ditches in relation to ditch sheds and effects on lakes and wetlands (pilot studies presently underway). 2) Riparian (green belt) survey of the ditches. 3) Aquatic macrobenthos indicator survey (pilot studies done on this). 4) General land use from aerial surveys, EROS, etc.

The second year would involve selected ditch site data gathering including: 1) Water chemistry (pilot study nearing

completion). 2) Water flow. 3) Sediments (suspended and surficial in the ditches). 4) Macrophyte Survey involving temporal nutrient tie-up and release (pilot study nearing completion). 5) Benthic indicators (pilot studies done).

The third year would involve data processing, the developing of models, and computer simulation of water quality and quantity as a result of the ditches. Both deterministic and stochastic models would be developed. Final write-up and cartography would also be accomplished during the third year.

ADDENDA: This project is also supported by: Mankato State University.

SUPPORTED BY U.S. Dept. of the Interior, Office of Water Research & Technology

5.0029, FORMATION OF ATMOSPHERIC AEROSOLS

K.T. WHITBY, Univ. of Minnesota, School of Engineering, *Minneapolis, Minnesota* 55414 (R803851-03; G601B-CA-01)

Aerosol size distributions have been measured in the St. Louis area as part of EPA's Project MISST using aircraft and ground-based self-contained mobile laboratories. These measurements were made with a group of collaborators such that a complete array of chemical, physical, and meteorological measurements were obtained on a coal-fired power plant plume. The University of Minnesota's portion of the project included aerosol measurements aboard an aircraft and the operation of a mobile van on the ground under the plumes.

This mobile van was also operated on freeways in the Los Angeles area during October 1976 as part of an EPA-sponsored project to study sulfur aerosols on roadways.

Much of the work during the next project year will be analysis and reporting of the large amount of data obtained during the past several years. Analysis is being directed toward obtaining aerosol growth rates in the plumes, aerosol nucleation rates in the plumes and surrounding atmosphere, and toward better descriptions of the aerosol size distributions. Laboratory work toward the development of a continuous instrument for the measurement of aerosol sulfur is also being partially supported by this project.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0030, INTERPRETATION OF DATA FROM BIOGENIC SULFUR FIELD STUDIES/MISTT TECHNICAL SUPPORT

UNKNOWN, Environmental Qual. Res. Inc., *St. Louis, Missouri* 63105 (68-02-2500; G625B-EA-13)

During the contract period the contractor will provide technical services as directed by the Project Officer through task orders. Such services will include but are not limited to: 1) prediction of size, shape and direction of power plant and urban plumes, 2) planning assistance (site selection and experimental design), 3) surface and vertical profile measurements (pilot balloons, radiosondes, helicopter flights, tower measurements), 4) measurement of vertical fluxes of pollutants, 5) calculation of wind fields and trajectories, and 6) preparation of appropriate data and interpretive reports. These services are expected to require approximately 700 man-hours during the contract period, but the contract should provide for the purchase of additional services in increments of 235 man-hours if they are needed. The contractor shall provide equipment, materials, and travel that may be required to perform assigned tasks.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0031, NEW AND IMPROVED PROCESSES FOR WESTERN SOFTWOODS

E.S. KOTOK, U.S. Dept. of Agriculture, Forestry Sciences Laboratory, *Missoula, Montana* 59801 (0000280; INT3201)

OBJECTIVE: Obtain the information necessary for the development of a numerically controlled dryer and determine the suitability of various wood species for millwork and associated products.

APPROACH: Numerically controlled wood-drying equipment requires knowledge of the relationship between wood characteristics and drying, measurement of these characteristics for machine inputs, and monitoring of the characteristics to control the drying process. This information will be obtained by laboratory experiments measuring energy transfer systems, intermediate moisture content levels, wood/moisture/energy requirements and remote sensing techniques. The suitability of species for millwork products will be accomplished through the development of millwork criteria and evaluation of different species by means of machining tests. Species availability, smoothness of wood, and ease of cutting are probably the main criteria that will be used to rate the various species for interchangeability.

PROGRESS: Multiple regression analysis of several variables enables prediction of moisture content in Douglas-fir and ponderosa pine lumber and internal vapor pressures generated in drying have been determined which enable more efficient drying schedules. A multi-discipline study of field chipping of residues under direction of this RWU has completed initial phases and pre- and post-inventory and product recovery data have been published. Continuing work is evaluating the influence of residue removal upon area esthetics, hydrology, soil chemistry and nutrient cycling, regeneration, and fuel characteristics, as well as influence upon the economics of subsequent management activities.

SUPPORTED BY U.S. Dept. of Agriculture, Forest Service, Intermountain Forest Experiment Station

5.0032, TROPHIC CLASSIFICATION OF LAKE MEAD UTILIZING CONTACT AND LANDSAT DATA

D.H. BOLAND, U.S. Environ. Protection Agcy., Env. Monitoring & Support Lab., *Las Vegas, Nevada* 89114 (J613B-22)

OBJECTIVES: The general objective is to determine the utility of LANDSAT multispectral scanner data for the investigation of the spatial-temporal aspects of trophic indicators and trophic state in a large lake (Lake Mead). Specific objectives include: 1. Development and evaluation of models to predict the magnitude of selected trophic indicators. 2. Development and evaluation of models to predict the trophic state of a lake. 3. Generation and evaluation of thematic photomaps which depict trophic indicator magnitudes and trophic index values within a lake.

APPROACH: Water quality data were collected from Lake Mead on 8 different dates during 1976 concurrently or near-concurrently with LANDSAT and NASA aircrafts. Remotely sensed data were acquired by multispectral scanners and aerial mapping cameras. Multispectral data from 20 LANDSAT scenes are being compared with the water quality data obtained from some 40 lake sampling sites and, if statistically significant relationships are found, thematic photomaps will be generated. The maps will display the temporal-spatial aspects of trophic indicators and a trophic index.

OUTPUTS: A report will be written describing the project results.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Support Lab.

5.0033, LIGHT AIRCRAFT SENSOR POD (ENVIRO-POD)

G.E. HOWARD, U.S. Environ. Protection Agcy., Env. Monitoring & Support Lab., *Las Vegas, Nevada* 89114 (D4-H492; J620A-42)

OBJECTIVES: The objective of this program is to demonstrate how essential remote sensing data can be provided by an alternative means that does not involve the high cost of acquisition and maintenance of organic aircraft or the expense of obtaining aerial survey under contract.

APPROACH: Through an interagency agreement with the U.S. Air Force at Wright Patterson AFB, Dayton, Ohio, the Environmental Protection Agency has tasked the Air Force Avionics Laboratory to design, test, and produce a sensor POD capable of being strapped on a commonly available, light utility aircraft with no modification or change in aircraft registration. The sensor POD developed must be capable of obtaining large-scale, high-resolution, black and white, color infrared photography.

CURRENT PLANS/PROGRESS: The ENVIRO-POD was issued a supplemental type certificate (STC) on 19 January 1977 by the Federal Aviation Administration.

During Fiscal 77 operational suitability testing was conducted in Regions I, II, III, IV, and Washington D.C. area. It has been recommended that POD production be accelerated.

A final report is to be prepared detailing the recommendations for ENVIRO-POD deployment, based on the demonstrations conducted.

Current plans call for the installation and testing of a thermal scanner for the POD and the identification of other possible sensors.

A training program will be developed for EPA offices acquiring an ENVIRO-POD.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Support Lab.

5.0034, ENERGY-RELATED AMBIENT AIR QUALITY MONITORING IN THE WESTERN ENERGY DEVELOPMENT AREA

R.N. SNELLING, U.S. Environ. Protection Agcy., Env. Monitoring & Support Lab., *Las Vegas, Nevada* 89114 (J625C-75)

OBJECTIVE: Provide integrated and validated air quality monitoring data (baseline and trend) for the western area of the U.S. which are or will be impacted by energy-related development activities. The geographic coverage includes the Northern Great Plains, Four Corners Area, Colorado Plateau (Oil Shale), Black Mesa, Arizona, and areas of New Mexico.

APPROACH: 1. Maintain inventory of existing and projected pollution sources and monitoring networks. 2. Integrate air quality monitoring data and assess impact of energy-related activities. 3. Conduct aircraft air quality monitoring missions to supplement ground-based network data.

OUTPUTS: 1. Annual reports of ground-based monitoring data; 2. Annual reports of airborne monitoring data.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Support Lab.

5.0035, REMOTE SENSING ASSESSMENT OF DAM FLOODING HAZARDS, METHODOLOGY DEVELOPMENT FOR THE NEW YORK STATE DAM SAFETY PROGRAM

W.R. PHILIPSON, Cornell University, School of Engineering, *Ithaca, New York* 14850 (A-081-NY)

The proposed research will develop or refine remote sensing techniques for inventorying dams, determining their hazard class, and assessing their condition. Through testing and field-checking of methods for deriving dam-related information for aircraft and satellite data, the investigation will aim to establish the most effective techniques that the New York State Department of Environmental Conservation could adopt to increase the efficiency and accuracy of inspecting the more than 7,000 dams in New York State.

SUPPORTED BY U.S. Dept. of the Interior, Office of Water Research & Technology

5.0036, EVALUATION AND DEVELOPMENT OF SAMPLING SYSTEMS FOR TRACE CONSTITUENTS OF AEROSOLS

A. BRESLIN, U.S. Energy Res. & Dev. Admin., Health Protection Engin. Div., *New York, New York* 10014

Systems are developed to meet the special sampling requirements for characterizing aerosols in low concentrations such as the stratospheric aerosol and tropospheric aerosols at remote locations. Attention is directed to sampling systems which are currently in use or have potential for deployment in the near future. The chief factors considered in system design and evaluation are: highest practical sampling flow rate consistent with high collection efficiency; clean, low-background collecting substrates; and handling procedures to minimize sample loss and cross-contamination.

RESULTS: A study of filter loading characteristics revealed a strong effect of humidity on air flow resistance for filters loaded with a hygroscopic aerosol. Fiber filters loaded with a dry uranine aerosol developed the expected large flow resistance, but upon exposure to a humid airstream the flow resistance returned to near the clean-filter value. The humidity effect is due to dissolution of uranine, reshaping the dendritic growths produced in dry loading into droplike configurations on the fiber surfaces, thereby greatly reducing the flow resistance.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Biomedical & Environmental Research

5.0037, DEVELOPMENT OF IN-STACK AND REMOTE PLUME OPACITY MEASUREMENT TECHNOLOGY

W.D. CONNER, U.S. Environ. Protection Agcy., Environ. Sciences Res. Lab., *Durham, North Carolina* 27711 (G712B-BA-17)

The objective of this task is to develop technology for plume opacity measurement both in-stack and remote and to evaluate the application to various industrial sources.

Simultaneous plume opacity measurements are made at a selected site by in-stack transmissometers, remote methods such as lidar, visual observers, sun photometer, and telephotometers. Particulate loadings are determined by EPA Reference Method 5 to provide information on possible correlation between mass and opacity for various types of emissions.

Studies have been conducted on a series of sources including coal and oil-fired power plants, Portland cement plants, Kraft recovery furnace and a phosphate fertilizer plant. Reports on tests and technology are available or are being prepared. Additional measurement method development and evaluation will continue.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0038, MONTANA COAL-FIRED POWER PLANT BIOENVIRONMENTAL STUDY

E. PRESTON, U.S. Environ. Protection Agcy., Ecological Effects Res. Div., *Corvallis, Oregon* 97330 (M625A-88)

The two objectives of this program are: (1) to develop procedures which can be used to forecast and assess the impacts of stressants from energy-producing activities on affected ecosystems; and (2) to identify and describe the impacts for a given set of ecosystems.

The approach is to combine field measurements with on-site field experimentation and laboratory process studies. Remote sensing, modeling activities, and other associated supportive efforts will be utilized to maximize the activity.

The Corvallis Environmental Research Laboratory has mounted a field effort in Montana. Besides the normal field facilities (mobile air quality laboratories, biological analysis systems, etc.) an effort has been made to coordinate the project with other scientific centers (Grassland IBP, ERDA, EPA and NOAA) to include the necessary scientific and engineering expertise to guarantee a unified program. It is intended that the research information gathered from this project be utilized in such a fashion that a set of biological parameters are found that will allow planning managers to project cost/benefit relationships prior to locating an energy producing facility.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Research Lab.

5.0039, SURVEY OF WASHED SHELL DEPOSITS IN SOUTH CAROLINA

J.A. TIMMERMAN, State Wildlife Resources Dept., *Columbia, South Carolina* 29202 (04-8-042-44007)

OBJECTIVES: 1. Determine distribution and quantity of washed shell deposits in South Carolina. 2. Provide management recommendations for state ownership of washed shell resource. 3. Select practical areas for harvest of this renewable resource as shell matrix or cultch. 4. Make available results of study, incor-

porating research and management recommendations for advisement, to commercial and recreational shellfish interests.

Aerial and land photographs of state's tidal area over 500,00 acres will be made. On-site inspections will be made to determine deposit volumes, quality of washed shells, and accessibility to navigable waters for harvesting.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Marine Fisheries Service

5.0040, COAL MINING IMPACTS - DEVELOPMENT OF ENVIRONMENTAL ASSESSMENT IN APPALACHIA
D.C. PARZYCK, U.S. Energy Res. & Dev. Admin., Environmental Sciences Div., *Oak Ridge, Tennessee* 37831 (W-7405-ENG-26)

This project is concerned with identifying the quantities and qualities of coal potentially recoverable from the Appalachian region, the competing uses for the land available for coal extraction in Appalachia, the environmental consequences incurred as a result of surface and deep mine development on water quality, wildlife, and recreation potential of Appalachia; and the areas within Appalachia which can be mined with the least adverse disturbance to the region. The research is being carried out to assess the environmental consequences of coal extraction in Appalachia and to determine the potential of Appalachian coal resources to meet future energy needs. Assessment methodologies will be applied to areas that are currently being mined and those most likely to be developed in the future. The ultimate goal of the project is to determine the relative environmental sensitivity of coal regions subject to potential coal mining within portions of Kentucky, West Virginia, and Tennessee.

RESULTS: The project has developed methodologies to analyze aerial photography and LANDSAT imagery to locate the extent of stripmining activity. Hydrologic data for use in development of a model to project the effects of surface mining on water quality was acquired and preliminary impact assessment measures developed. Aesthetic impact assessment techniques were developed for a test area. Software to identify and locate land-cover types from LANDSAT digital data has been improved and methodology to quantify land-use and wildlife habitat alteration resulting from mining is being developed.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Biomedical & Environmental Research

5.0041, HALOCARBON ANALYSES IN THE ST. LOUIS, MISSOURI METROPOLITAN AREA
R.A. RASMUSSEN, Washington State University, School of Engineering, *Pullman, Washington* 99163 (68-02-2421; G625B-EA-17)

The research program has two objectives: 1) To analyze the halocarbons and hydrocarbons in air samples collected by the field studies in the St. Louis area. Particular emphasis will be placed on detailed C2 to C12 hydrocarbons measurements from both aircraft and ground sampling stations. In addition, a complete analysis of the halocarbons will be accomplished, especially the fluorocarbons 11 and 12 and the chlorocarbon cleaning solvents. 2) To provide future field support via an instrumented field laboratory, meteorological support for coordinating aircraft studies and interpreting stagnating anticlone weather situations. In addition, the installation of specially programmed automated halocarbon instrumentation, and/or manually operated high-resolution hydrocarbon instrumentation in government-owned mobile aerosol laboratory will be accomplished at the request of the government.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0042, RURAL OXIDANT STUDIES AND THE ROLE OF NOX IN RURAL OXIDANT FORMATION
H. WESTBERG, Washington State University, School of Engineering, *Pullman, Washington* 99163 (R805343-01; G603A-AC-08)

The purpose of this research study is to investigate the source of high oxidant levels in rural areas. Specific goals include monitoring individual hydrocarbons in the C2 - C10 molecular weight range, NOx and ozone in non-urban areas of the western and mid-western United States. The study will involve both ground-based and aircraft monitoring. We also plan to conduct a number of natural sunlight irradiation experiments designed to provide information about how fresh inputs of NOx affect photochemical behavior of rural air masses. The field portion of this study is scheduled for July and August of 1977.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0043, CONTINUATION AND SUPPLEMENT OF CASE STUDIES EMPLOYING SATELLITE INDIRECT SOUNDINGS
L.H. HORN, Univ. of Wisconsin, School of Natural Sciences, *Madison, Wisconsin* 53706 (8-612; 04-4-158-2 MOD. NO. 7)

TECHNICAL OBJECTIVES: The objective of this research is to exploit indirect temperature soundings to enhance conventional data sources in describing and predicting weather systems. Emphasis is directed to severe or potentially severe weather where the high spatial density of satellite observations can fill in scales below the resolution of the rawinsonde network. Attention is also focused on using the satellite observations between regular 12-hourly radiosonde reporting times to increase temporal resolution in rapidly developing weather.

APPROACH: A case study approach is used with data obtained from the Nimbus-5 and Nimbus-6 satellites. Objective analysis techniques are developed for use with satellite temperature data to demonstrate: (1) the ability to define the horizontal and vertical wind shear from satellite-derived temperatures; (2) the vertical and horizontal resolution of temperature fields obtainable with current satellite data. Particular situations explored include: (a) the fine structure within and around the jet streak in tornado/severe thunderstorm situations; (b) the location of critical thickness contours in snow vs. rain conditions; (c) the detailed evolution of intense cyclogenesis.

PROGRESS: Objective analysis systems have been developed and demonstrated with temperature data derived from Nimbus-5 and Nimbus-6 data. Work has begun on including these data in the initial fields of the National Meteorological Center Local Fine Mesh (LFM) forecast model. The capability of defining the vertical and horizontal resolution of temperature and wind shear to at least the resolution of the LFM model has been demonstrated. The satellite data has been shown to be spatially somewhat more consistent than radiosonde data. Over the United States, the satellite data has been shown to provide very reasonable continuity in depicting a rapidly developing baroclinic weather system between radiosonde observation times. Also, they have been shown useful in providing detailed geostrophic wind fields with good continuity between rawinsonde observations.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0044, STUDIES OF THE ATMOSPHERE USING AEROSPACE PROBES
V.E. SUOMI, Univ. of Wisconsin, Space Science & Engr. Center, *Madison, Wisconsin* 53706 (8-012; 04-6-158-44087 MOD. NO. 3)

OBJECTIVE: Continue studies of satellite data--principally images from geostationary satellite but augmented with polar-orbiter data in active areas--as a means of describing and predicting mesoscale development leading to severe storms.

APPROACH: Use recently acquired rapid-sequence GOES images (15 min. and 3 min. intervals rather than the routine 30 min. interval) to study development of severe storms with mesoscale. Combine these studies with conventional studies of the periods preceeding and following the active development phases in order to identify build-up patterns.

PROGRESS: Much of the past effort has been devoted to tropical systems which have laid the foundation to descriptors for mid-latitude systems. These include: (1) Rainfall estimates from cloud cover, type and development; (2) Circulation studies using

cloud motions as the indicator (the GATE area in particular was stressed); (3) 3-dimensional mass divergence in the vicinity of tropical cloud clusters.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, RESEARCH PSYCHOLOGY APPLIED TO MEDICALLY SIGNIFICANT PROBLEMS IN ARMY AVIATION
K.A. KIMBALL, U.S. Army, Aviation Psychology Division, *Ozark, Alabama* 36360 (DA0D6738)

To provide US Army aviation information that is medically important about the human factor in the aircraft man-machine system, with special emphasis on the performance of this human factor and the variables that influence it.

The approach will involve the application of current research techniques applicable to the objective as well as developing new techniques as required.

SUPPORTED BY U.S. Dept. of Defense, Medical Research & Development Command, Aeromedical Research Lab.

6.0002, MILITARY APPLICATIONS OF AUDITORY ASSESSMENT
J.H. PATTERSON, U.S. Army, Bioacoustics Division, *Ozark, Alabama* 36362 (DA0B6885)

The need for precise predictors of job performance potential or limitation associated with auditory deficit is urgent. The current hearing profile scheme is virtually meaningless, both to medical professionals and commanders. Noise-induced hearing loss is now at epidemic proportions in the Army. Investigation of techniques, materials, procedures, and instrumentations for assessing auditory perception, susceptibility to acoustic insult, job performance prediction based on audiometric test results, relationship of auditory deficits and work noise environment affecting job performance and quantification of typical hearing loss in special acoustic environments will be undertaken.

Experiments will be initiated to study the speech discrimination capability of auditorily deficient army aviators in noise environments. Development and standardization of speech discrimination materials will be undertaken to establish a basis for granting 'waivers' to Army aviators with hearing losses. In conjunction with studies of high-intensity impulse noise field audiometric testing and assessment of temporary threshold shift will be undertaken. Basic studies of auditory perception will be conducted to provide baseline data for new audiometric procedures.

SUPPORTED BY U.S. Dept. of Defense, Medical Research & Development Command, Aeromedical Research Lab.

6.0003, SATURATED HEATED OXYGEN/BLEED AIR NEBULIZER FOR RESUSCITATION OF THERMAL CASUALTIES IN AIR EVACUATION
F.S. PETTYJOHN, U.S. Army, Aviation Medicine Res. Div., *Ozark, Alabama* 36360 (DA0B6902)

To develop and test the concept of use of heated saturated oxygen/bleed air in helicopter air evacuation/resuscitation of the hypothermic or pulmonary casualty.

Develop new technology and equipment to use helicopter bleed air and electrical power 28 vdc or 115v400Hz to provide a source of heated, dry or supersaturated oxygen or air to deliver heat to the hypothermic combat casualty. The concept of the lungs as a heat exchanger employing the extremely large surface area available for the passage of blood as a distributer of heat to distal organs represents a unique application in air evacuation and resuscitation. The equipment will be designed for simplicity, low cost, and compatibility with UH-1 and UTTAS aeromedical helicopters. Compatibility with advanced oxygen systems (chlorate candle and Army molecular sieve oxygen generators) will be explored. Concept and prototype evaluation will be conducted using mongrel dogs as subjects. Monitoring of temperature and pulmonary effects of increased inspiratory air/oxygen during simulated and in-flight air evacuation missions will be accomplished.

SUPPORTED BY U.S. Dept. of Defense, Medical Research & Development Command, Aeromedical Research Lab.

6.0004, RESEARCH OF VISUAL PROBLEMS MEDICALLY SIGNIFICANT TO ARMY AVIATION
R.W. WILEY, U.S. Army, Biooptics Division, *Ozark, Alabama* 36360 (DA0B6891)

To provide information about the visual sensory modality relating to capability of the human visual system and the impact of military equipment, environmental and operational influences on visual performance and integrity.

The approach will include psychophysical, electrophysiological, and other objective techniques to evaluate human visual performance with quantitative measures.

SUPPORTED BY U.S. Dept. of Defense, Medical Research & Development Command, Aeromedical Research Lab.

6.0005, USE OF CAMPUS FACILITIES AND SERVICES BY NASA TO SUPPORT RESEARCH IN CHRONOPHARMACOLOGY
C.E. WALKER, State University of Fla. Sys., School of Science & Technology, *Tallahassee, Florida* 32307 (NCA 2-230701)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0006, HUMAN FACTORS ENGINEERING IN SUPPORT OF ARMY AVIATION
C.A. FRY, U.S. Army, Human Engineering Labs., *Aberdeen Proving Ground, Maryland* 21005 (DA0C4955)

To devise means of simplifying helicopter crewstation through effective control/display integration for enhancing mission performance in night, terrain flying operations. Establish human performance criteria for performing aircraft maintenance in the forward area under night conditions.

Design parameters will be established for optimizing the interaction of the aircrew with the helicopter through a process of analysis, mock-up simulation, and flight test. The major problems to be addressed are control/display arrangement in the cockpit, CRT integration, symbology parameters, navigational accuracy, communication simplification, target hand-off and aircraft control simplification. Maintenance tasks will be analyzed to ascertain potential for simplification and the value of tactile cues for night, forward area operations. A focal point of cockpit instrumentation will be established to insure sound integration of all equipment which interfaces with the crew.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Human Engineering Lab.

6.0007, HEALTH CHANGES IN AIR TRAFFIC CONTROLLERS
UNKNOWN, Boston University, Graduate School, *Boston, Massachusetts* 02215 (FA38619; FA73WA-3211)

Biomedical research study for the purpose of determining the kinds and degree of health changes occurring in air traffic controllers, and the causes of such changes.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin., Systems Research & Development Service

6.0008, CENTRAL NEURAL AND NEUROCHEMICAL MECHANISMS SUBSERVING POSTURAL CARDIOVASCULAR CHANGES

D.J. REIS, Cornell University, School of Medicine, *New York, New York* 10021 (NSG 2259)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0009, CHANGES IN THE ORGAN OF HEARING PRODUCED BY SOUND

D.J. LIM, Ohio State University, School of Medicine, *Columbus, Ohio* 43212 (DF322410; F33615-77-C-0512)

The purpose of this work unit is to examine changes in the auditory system produced by exposure to excessive sound. The effort will emphasize studies in the infrasound (1-20 Hz) region and long-term, low-level exposures at mid-frequencies (600-2000 Hz). Goal of the research is a reasonable hypothesis of the mechanism of injury production that provides a rationale for treatment and prevention. Results of this basic research are used in the AMRL applied technology program in establishing guidelines for limits of exposure and methods of protection from exposure to excessive sound. Ultimately this forms the basis for Air Force regulations governing exposure and protection criteria. Data are also used by the Environmental Protection Agency.

Infrasound exposures will be carried out only on experimental animals. Long-term, low-level exposures will be carried out on experimental animals and human volunteer subjects at levels which do not produce permanent changes in hearing. Techniques to be employed include light and electron microscopy of inner ear structures, electrophysiological measures of middle ear muscle activity and psychoacoustic measures of changes in auditory acuity.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab BB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0010, ANALYSIS OF AERODYNAMIC DECELERATION INJURIES DURING EMERGENCY ESCAPE

C.F. ACEVEDO, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321450)

Injuries caused by aerodynamic deceleration during emergency escape from high-performance aircraft using open ejection seats are a serious problem under non-combat conditions and a major combat ejection problem. These injuries, which may be life-threatening at their onset, also increase the possibility of fatality in final phases of escape, i.e., parachute opening shock, descent, landing impact, post-escape survival and rescue. Aeromedical criteria must be established to support development of protective equipment. The objective of this effort is to: (1) provide medical descriptions of operational injuries, (2) determine the injury mechanisms, (3) establish a basis for prioritizing biomechanical research on this problem and (4) provide aeromedical criteria for injury prediction models and protection techniques.

All accident reports from 1965 to present in which there is a possibility of injury from aerodynamic deceleration will be reviewed in detail. The review, accomplished in collaboration with the Deputy Inspector General for Inspection and Safety, will include analysis of ejection conditions, Flight Surgeon's evaluation of injuries, X-rays and long-term effects of the injuries. Injuries occurring during the investigation will be studied directly on a physician-to-physician basis. Research results will be made available to the Naval Air Systems Command as well as USAF laboratories and product divisions.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab BB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0011, DEVELOPMENT OF MODEL FOR THORACIC DYNAMICS

I. KALEPS, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF323090)

Prediction of the mechanical response of the human thorax resulting from direct impacts or variable high-level air pressure exposures and corresponding probabilities of injury occurrence are required for the formulation of criteria for the design of manned flight systems. This effort will provide an analytic computer-based model for relating external body exposure parameters to the resulting dynamic response of the human chest wall, intrathoracic volume and flow of respiratory gases through the trachea. These model response parameters will, in turn, be used in generating injury probabilities for prescribed exposure events.

The modeling approach used will account for the motion of the chest wall, the visceral contents below the diaphragm, the intrathoracic volume and the flow of respiratory gases through the trachea. Linear, and where necessary nonlinear, elastic properties will be used for coupling of the chest wall and visceral mass to the thoracic structure. Internal coupling resulting from pressure variations within the thoracic cavity will be considered for both adiabatic and isothermal processes. Resistance to flow through the trachea will be modeled for both the laminar (slow flow) and turbulent (fast flow) cases. Injury criteria will be developed by correlating response parameters to injury incidence and severity as observed in experiments reported in literature.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab BB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0012, GLAUCOMA

T.J. TREDICI, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF323020)

Glaucoma has long been recognized as an important cause of ophthalmologic morbidity and removal from flying status in USAF aircrew personnel. A concerted effort is made at base level to identify affected aircrew personnel early, based on elevated intraocular pressure. This is most practically performed by using the Schiotz tonometer. The use of this instrument is taught to all flight surgeons during their course of instruction at USAFSAM. Further, the use of tonometer as part of the base-level follow-up program is the most important part of the USAF policy on glaucoma. The objective of this work unit is to evaluate criteria for diagnosis, to delineate factors or characteristics which identify the point in the disease process when therapy should be instituted, to evaluate therapeutic modalities for both efficacy of treatment in absence of visual side effects which would contraindicate the performance of further flying duties, and where possible, to identify factors which causally relate progression of the disease.

The approach will involve careful and detailed ophthalmologic evaluation of each individual patient, with both follow-up interval and decision to commence therapy to be determined on an individual basis. The extensive and changing knowledge in literature in this field, both military and civilian sources, will be utilized as well as the accumulated expertise of the Ophthalmology Branch, Clinical Sciences Division, in follow-up and treatment of this disorder in aircrew personnel. The study will also include those patients with a diagnosis of glaucoma who are on therapy with epinephrine drops which is recognized as efficacious and accepted by the Surgeon General for chronic use while retaining flying status (AFR 160-12). Work under this unit was formerly conducted under 7755-09-05 and 7755-09-04.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine NG, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense, Air Force

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, INVESTIGATION IN NONLINEAR MECHANICS 11600-M

W.S. LOUD, Univ. of Minnesota, School of Liberal Arts, *Minneapolis, Minnesota* 55455 (DA0D9150; DA-ARO(D)-31-124-73-G199)

To investigate the stability and branching of nonlinear equations. The class of differential equations considered occur in the analyses of dynamical and vibrational systems. The proposed investigation is particularly relevant in the study of nonlinear control problems associated with weapon systems and in the study of stability of large deformations of structures like those incountered in aircraft.

Areas of research will include: (1) Study of stability regions of ordinary differential equations. (2) Further study of implicit function theorem with reference to branching of solutions of differential equations. (3) Application of branching theory to boundary value problems other than periodic solutions. (4) Study of generalized inverses of differential operators.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Army Research Office

7.0002, ACCELERATION OF CONVERGENCE
D.A. SMITH, Duke University, Graduate School, *Durham*, *North Carolina* 27706 (NSG 3160)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, PROPERTIES OF CONDUCTION ELECTRONS IN METALS
R.W. STARK, Univ. of Arizona, School of Liberal Arts, *Tucson*, *Arizona* 85721 (DMR77-03683)

This research program will be directed to experimental studies of lifetimes and Fermi surface effects for electronic transport in pure or nearly pure metals. The first of these studies relates to experiments on electron quantum states having very long quantum state lifetime in magnesium. The now well understood electron quantum interference effect in magnesium will be used to measure the effect of electron-electron and electron-phonon scattering on the quantum state lifetime. Also, this effect will be used to investigate alloy effects in the concentration (C) range of 0.1 ppm less than C less than 20 ppm. Another ramification of the very long quantum state lifetime for electrons in pure magnesium which will be investigated is Pippard's magnetic band structure generated by magnetic breakdown for critical directions of the magnetic field. The second principal area of research centers around measurements of the de Hass-van Alphen effect in ferromagnetic nickel. The basic measurements of the de Haas-van Alphen spectrum for nickel will be completed in order to determine the complete Fermi surface. Also, the effective cyclotron masses will be determined on this surface. This latter data will be used to determine the two spin densities-of-states for nickel as well as obtain information about the many-body electron magnon renormalization effects.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0002, THEORETICAL SOLID-STATE PHYSICS
M.L. COHEN, Univ. of California, School of Letters & Science, *Berkeley*, *California* 94720 (DMR76-20647 A01)

Research previously supported under DMR72-03206 will be continued. A broad program in theoretical solid-state physics and material research in the fields of semiconductors (electrical and optical properties), superconductors, magnetic materials, surfaces, electron hole drops, amorphous solids and interactions of monopoles with crystals will be undertaken. The empirical pseudopotential method will be used in the calculation of the electronic properties of semiconductors and superconductors.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0003, SMALL SOLID PARTICLES IN BEAMS
W.D. KNIGHT, Univ. of California, School of Letters & Science, *Berkeley*, *California* 94720 (DMR75-22607 A02)

Research on the electronic properties of small metallic particles, previously supported under DMR-7202980 AO3, will be continued. In order to eliminate effects due to the matrix in which the metal particles are embedded, a beam of particles will be constructed, and magnetic, electric, and optical experiments will be performed on them as they fly. It is expected that the particles containing odd numbers of electrons may be deflected in inhomogeneous magnetic fields in the manner of the Stern-Gerlach experiment, and that any particle may be deflected in inhomogeneous electric fields. Refocusing of the beams as in the experiment of Rabi, with various resonance experiments imposed between the focusing and refocusing fields, will allow sensitive measurements of magnetic moments, electric polarizabilities, optical properties, energy levels and g-factors as well as hyperfine effects. Very homogeneous particle size distributions can be obtained, and precise measurement of the solid and surface properties of the particles can be made, including relaxation times relative to the time flight of the particles in the beam. The method is applicable over a wide range of particle sizes ranging from a few atoms in 'clusters' to 'small particles' containing a thousand atoms or more.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0004, ISOTOPIC STUDIES ON RARE GASES IN TERRESTRIAL SAMPLES AND IN NATURAL NUCLEOSYNTHESIS
J.H. REYNOLDS, Univ. of California, School of Letters & Science, *Berkeley*, *California* 94720 (EY-76-03-0034-032)

We use rare-gas mass spectrometry, broadly speaking, to read the natural record which the isotopes of the rare gases comprise as trace constituents of natural gases, rocks, and meteorites. Working with terrestrial samples we note that in both gases and rocks the rare gases occur as recycled atmospheric gases, as radiogenic gases from natural radioactivity, as much rarer radiogenic gases from extinct radioactivities, and possibly as primordial component. A new program with us is to design, construct, and operate apparatus which will analyze rare gases from terrestrial fluids in the field, at or near the sampling site. Long-range scientific goals are to search for more manifestations of primordial gases and to see how they relate to convection patterns within the earth. We will also examine the rare gases from geothermal energy sources so as to assay the proportions of recycled atmospheric gas and radiogenic gas. We are continuing interest in geochronology. Our studies in natural nucleosynthesis make use of the meteorites and the clues they contain to the chronology of nucleosynthesis by virtue of the presence of traces of rare gases which are daughter products of extinct and extant radioactivities. We are also interested in isotopic anomalies in carbonaceous meteorites, and the possibility that they may originate because of incomplete isotopic mixing of fractions with different histories of nucleosynthesis.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Physical Research

8.0005, EQUIPMENT FOR RADIATION STUDIES OF HIGH-DENSITY PLASMAS
F.F. CHEN, Univ. of California, School of Engin. & Appl. Sci., *Los Angeles*, *California* 90024 (ENG77-17861)

Two equipment items will be purchased which will extend measurement capabilities at the University of California-Los Angeles in research on high-density plasmas. Current work in the Plasma Engineering Laboratory is along two main lines: 1) Investigation of nonlinear, parametric interactions between intense CO2 laser light and dense plasmas, and 2) Development of far-infrared laser diagnostic techniques for fusion reactor plasmas. At the high densities involved in these studies, the most attractive diagnostic techniques include spectroscopy and ruby laser Thomson scattering. A ruby laser and an optical multichannel analyzer will be purchased to provide this instrumentation. The latter is to be used both for laser scattering and ordinary spectroscopy.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

8.0006, DEVELOPMENT AND TESTING OF A SUPERCONDUCTING ELECTRON ACCELERATOR WITH RECIRCULATION OF THE BEAM, AND NUCLEAR PHYSICS EXPERIMENTATION

H.A. SCHWETTMAN, Stanford University, School of Hum. & Sciences, *Palo Alto, California* 94305 (PHY76-80168 A01)

This is the second year of a continuing two-year grant PHY76-80168. Essential progress has been made in solving technical problems, particularly involving multipacting, which had severely hindered the operation of the superconducting radio frequency cavities. Calculations and tests indicate that by altering the cavity geometry the effects of multipacting can be reduced to the point where it no longer is the limiting factor in cavity performance. Existing cavities will be modified and new ones designed and fabricated.

The accelerator development program will continue. Important beam diagnostic studies will be done. It is anticipated that the four-orbit recirculation system will be demonstrated under reliable operating conditions.

It is also expected that some selected nuclear physics experiments will be completed to demonstrate the unique advantages of the superconducting electron accelerator which include the high duty factor, energy resolution and intensity at medium energies. The experiments will deal with electron excitation of giant nuclear resonance and observation of subsequent charged particle decay modes.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0007, AMORPHOUS SILICON BY NEUTRALIZED ION BEAM SPUTTERING

J.R. SITES, Colorado State University, School of Natural Sciences, *Fort Collins, Colorado* 80521 (NSG 3167)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0008, MAGNETIC CRYSTALS WITH WEAK INTERACTIONS

W.P. WOLF, Yale University, Graduate School, *New Haven, Connecticut* 06520 (DMR76-23102 A01)

Research previously funded under grant DMR73-02405 will be continued. The work covers several related areas: 1. Experimental studies of multicritical points, including work on tricritical, bicritical and wing critical points. 2. Domain studies near phase transitions. 3. High-frequency relaxation measurements of magnetic specific heats. 4. High-sensitivity magnetometry, development of a SQUID magnetometer. 5. Phonon contributions to bulk magneto-thermodynamic properties, a heat capacity study of non-additive effects. 6. Phase transitions in mixed crystals including mixed antiferromagnetic-ferromagnetic and antiferromagnetic-diamagnetic crystals. 7. Preparation of new magnetic materials, including high-pressure hydrothermal synthesis of rare-earth hydroxides and hydroxy carbonates. The principal objective of all these studies is to seek direct confrontation between theory and experiment, with a view to improving our understanding of the microscopic processes important in magnetic materials.

This is the first year of a 3-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0009, COPPER ADSORBATE SYSTEMS

P.E. BEST, Univ. of Connecticut, Graduate School, *Storrs, Connecticut* 06268 (INT77-09452)

Dr. Philip E. Best, Physics Department, University of Connecticut, is collaborating for seven months beginning in January 1978 with Dr. Philip Jennings and his colleagues at Murdock University on a study of chemisorption on copper surfaces. The study is concentrating on the copper-carbon monoxide surface system. Low-energy electron diffraction (LEED) is being used to obtain structural information; Auger electron spectrometry (AES) is being used to monitor surface contaminants and CO coverage (as well as to provide some information on changes in the electronic structure that occur on adsorption); and infrared reflection spectroscopy (IR) is being used to obtain information concerning the orientation and configuration of the CO molecules at the surface. Although this research is primarily of scientific interest, the result may be of technological interest in that copper is an important component of catalysis used in the synthesis of methanol from coal gas.

SUPPORTED BY U.S. National Science Foundation, Div. of International Programs

8.0010, SOLID STATE SCIENCES COMMITTEE - STUDY OF RESEARCH FACILITIES AND SCIENTIFIC OPPORTUNITIES IN THE USE OF LOW-ENERGY NEUTRONS

C.K. REED, Natl. Acad. of Sciences, *Washington, District of Columbia* 20037 (DMR77-10702; C310-TO-360)

An assessment of the scientific and technological opportunities in the use of low-energy neutrons as a tool for research on the properties and structure of matter will be carried out. It will also encompass an evaluation of existing experimental facilities and of the need for advanced new facilities for carrying out this research. This assessment will be performed by an ad hoc panel to be appointed by the Chairman of the Nationl Research Council and meeting under the auspices of the Solid State Sciences Committee of the NRC.

This study will address the opportunities in the use of low-energy neutrons to pursue forefront scientific goals in the areas of condensed matter and materials sciences, biology, chemistry and geology. The study will consider both the adequacy of current reactors and possible modifications to upgrade these facilities, as well as needs for new types of neutron sources, such as the pulsed accelerator-based systems. The study will also specifically consider the various institutional arrangements for the use of neutron facilities and their program support. It will bring to the surface changes which would help optimize the use of such facilities by the entire scientific and technical community.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0011, COLLISION INDUCED OPTICAL SPECTRA OF SOLIDS

E.W. THOMAS, Georgia Inst. of Technology, School of Sciences & Lib. Stu., *Atlanta, Georgia* 30332 (DMR77-04110)

Impact of energetic rare-gas ions (5 to 200 keV) on surfaces gives rise to optical emissions from excited molecules (or radicals) on the surface or from sputtered molecules outside the surface. The spectral characteristics identify the nature of the chemical species and the emission intensity is related to the density. By monitoring the molecular emission intensity as a function of atomic surface composition one may determine the mechanism and rate of a chemical reaction. Cyanide radical (CN) formation on alkali halides is characterized by the emission of CN bands at 270 nm under light ion bombardment. The relationship of CN density to coverage of adsorbed CO2, H2O and N2 is studied to elucidate the reaction mechanism and rate. It has been proposed that formation of hydrocarbons in space is related to stimultaneous C ion and H ion bombardment of interstellar dust and meteorites; this is studied by implanting C ion and H ion into various materials (e.g., metals, carbides, and silicates) and monitoring the emission of CH bands under subsequent Ar ion bombardment.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0012, MICROSCOPIC THEORY OF NUCLEI, NUCLEAR, AND NEUTRON STAR MATTER

V.R. PANDHARIPANDE, Univ. of Illinois, School of Liberal Arts & Sci., *Urbana, Illinois* 61801 (PHY76-22147 A02)

Research in the microscopic theory of nuclei, nuclear and neutron star matter which was initiated under NSF grant PHY74-22148 A01 will be continued. Specific topics to be investigated

include: 1) development of a variational theory for dense systems; nuclear and neutron star matter in particular, 2) a study of nucleon-nucleon (N-N) interaction models, 3) relativistic many-body systems, 4) a study of possible phases of matter at super-nuclear densities, 5) calculation of neutron star models and their observable properties, 6) microscopic calculation of the structure of finite nuclei.

The past two years have seen spectacular developments in the related experimental and observational fields. Masses of three compact sources believed to be neutron stars have been determined as about 1.4 M while the maximum mass supportable by a noninteracting neutron gas is only 0.7 M. Thus the predicted large influence of N-N interaction on the structure of neutron stars has been observed. A measurement of the moment of inertia of a 1.4 M neutron star within even 20% accuracy will give us direct and significant information on the equation of state of neutron star matter. One could hope that heavy-ion collision experiments may provide information about the equation of state of nuclear matter of high densities. A major aim of the present program is to theoretically calculate these equations of state.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0013, THEORY OF CONDENSED MATTER

G.D. MAHAN, Indiana University, School of Arts & Sciences, *Bloomington, Indiana* 47401 (DMR77-11305)

Theoretical research in solid-state physics previously supported by NSF grant DMR-7302598 AO2 will be continued. A major effort will be devoted to developing an understanding of X-ray absorption and emission, Auger spectroscopy, photo-emission and inelastic electron scattering in solids using the techniques of many-electron theory. These have been active experimental areas recently, particularly those involving the use of synchrotron radiation. The goal of the research is to develop an improved understanding of the experimental results. Also, renormalization group techniques will be used to investigate order-disorder transitions in condensed matter systems.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0014, ATOMIC PROPERTIES RELATED TO ION STOPPING AND METHODS OF DE-EXCITATION 9827-P

C.P. BHALLA, Kansas State University, School of Arts & Sciences, *Manhattan, Kansas* 66506 (DA0C9284; DAAG29 77 G0029)

To perform theoretical calculations of the X-ray rates, the Auger rates, and the fluorescent yields for inner-shell vacancies in atoms. This research bears a potential relevance to nuclear weapons effects on missiles, to the development of a gamma-ray laser and to ion implantation and channeling. The Auger electron spectroscopy likewise relates to surface studies for electron devices, to radiation damage and to the identification of chemical components. (Text abridged.)

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Army Research Office

8.0015, ATOMIC PHYSICS WITH HIGHLY IONIZED IONS

P. RICHARD, Kansas State University, School of Arts & Sciences, *Manhattan, Kansas* 66506 (EY-76-S-02-2753)

Atomic physics with energetic highly ionized ions will be performed under five programs to study (1) the production of X-rays in solid media, (2) the processes of electron loss and gain in gas media, (3) X-ray spectroscopy in ion-atom collisions, (4) atomic collisions theory and (5) applications and developments with heavy ion beams. The process of electron capture will be studied experimentally and theoretically under topics 1, 2, 3, and 4. Alignment of atomic states will be investigated through the observation of target and projectile radiation. The target thickness dependence of X-ray yields will be studied to obtain target and projectile vacancy production and vacancy quenching cross sections in solids. X-ray spectroscopy of heavy ions will be initiated for X-rays with energy approximately greater than 4 keV using a new Cauchois spectrometer. Impact parameter dependences of cross sections will be extended to heavier ion partners.

RESULTS: During the 12-month period from 1 August 1976 to 31 July 1977, 19 scientific papers were published, 10 scientific papers are in the process of publication and 23 contributed and invited papers were presented on a wide range of experimental and theoretical analysis of ion-atom interactions at high energies.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Basic Energy Sciences

8.0016, NUCLEAR MOMENTS AND NUCLEAR STRUCTURE

Y.K. LEE, Johns Hopkins University, School of Arts & Sciences, *Baltimore, Maryland* 21218 (EY-76-S-02-3274)

We propose to complete the system designed to study energetic central collision of heavy ions to study the properties of nuclear matter via the emission of gamma rays. An initial study proved very successful and the group is approved for further study beginning in 1978. Follow-up studies of high-spin nuclear states resulting from pion capture are in progress and will continue in the future. High-precision data using a curved crystal spectrometer in collaboration with groups from Yale and Columbia will be carried out at Nevis as an additional program to study the excitation of nuclei via pion capture.

The experiment on the nuclear moments of beta emission is being completed and will take new directions in the future. The programs on electrons and positrons from high-energy collisions will continue. Some future experiments are also being planned for the measurement of linear polarization of gamma rays resulting from high-spin excitation of nuclei.

RESULTS: A new program studying the behavior of nuclear matter under very high excitation was begun at the Bevatron with experiments designed to study the gamma radiation emitted from central collision of heavy ions. A preliminary experiment showed the feasibility of the system and gave the first results of correlations of gamma rays with such collisions. Studies of electrons resulting from heavy-ion collisions using a special high acceptance beta spectrometer were made indicating the beginnings of effects that are complements of the so-called combined atom X-ray phenomena.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of High Energy & Nuclear Physics

8.0017, SOLID-STATE PHYSICS STUDIES WITH POSITRONS

S. BERKO, Brandeis University, Graduate School, *Waltham, Massachusetts* 02154 (DMR76-24376 A01)

Solid-state physics research using positron annihilation techniques previously supported by NSF grant DMR73-02563 A03 will be continued. The research program consists of two projects: a) electronic momentum density measurements using a newly built 64 counter two-dimensional angular correlation apparatus, and b) slow positron interaction studies with solid surfaces. Under project a) the Fermi surfaces and the electronic band structure of disordered as well as of some ordered alloys, and the electronic momentum densities in ferromagnetic metals will be investigated. In the slow positron beam experiments (project b), an ultrahigh vacuum system will be built to allow the study of well-specified surfaces. The formation of positronium by slow positrons at metal surfaces, the physics of positron work-function and positron emission from solid surfaces, as well as slow positron scattering will be studied experimentally. The parameters of the electronic dipole barrier at metal surfaces will be determined from these experiments.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0018, HIGH-ENERGY INTERACTIONS

M.A. ABOLINS, Michigan State University, School of Natural Sciences, *East Lansing, Michigan* 48824 (PHY77-25664)

Current work in progress involves: 1) High Energy pp, pp and pip Interactions in the FNAL 30' Bubble Chamber Hybrid System (FNAL-E2B, E281, E311, P394); 2) A Study of Inclusive Production of Neutral Kaons on Hydrogen (FNAL E-383); 3) Intermediate Energy Antiproton Proton Annihilation States (SLAC BC-64); 4) Search for Narrow High Mass States (FNAL E-366, nearly complete); 5) Search for Gamma Transitions in Antiproton Proton Annihilation at Rest and Low Energies (BNL E708); 6) Triple Search and Intermediate Energy Negative Kaon Proton Interactions (ANL E-289, CERN-1209); 7) Search for Charm at CERN (CERN W-11).

This work represents a continuation of that currently supported by Foundation grant PHY76-01730 A02.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0019, HIGH-PRECISION NUCLEAR MAGNETIC SUSCEPTIBILITY MEASUREMENTS IN SOLID 3 HELIUM
P.B. PIPES, Dartmouth College, School of Arts & Sciences, *Hanover, New Hampshire* 03755 (DMR77-04665)

The principal investigator will perform high-precision nuclear magnetic susceptibility measurements at the National Bureau of Standards during the summer of 1977 in collaboration with R.J. Soulin and C.T. Van Degrift. A new tunnel diode technique will be used to measure the absolute susceptibility and the temperature scale will be determined from the newly developed superconducting transition temperature reference points. The measurements will contribute to our fundamental understanding of nuclear exchange in quantum solids.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0020, THEORETICAL PLASMA PHYSICS RESEARCH
M.N. ROSENBLUTH, Princeton University, School of Natural Sciences, *Princeton, New Jersey* 08540 (EY-76-S-02-3237)

Work is proposed on the following topics: 1. Nonlinear Tearing Modes in Tokamaks; 2. Ballooning modes; 3. Effects of Alpha Particles; 4. Drift Tearing Modes and Stochastic Magnetic Fields; 5. Electron Cooling of Ion Beams; 6. Ion Ring Stability; 7. Shear Alfven Modes in High Beta Mirrors; 8. Tormac Research; 9. Ruelle-Takens Attractor Theory; 10. Drift Convective Cells.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Magnetic Fusion Energy

8.0021, THEORETICAL PHYSICS
A.S. WIGHTMAN, Princeton University, Graduate School, *Princeton, New Jersey* 08540 (PHY76-80958)

Investigation of a series of problems in quantum field theory, statistical mechanics and general mathematical physics will be carried out. The work will include the extension of existing results on Yukawa interactions in constructive field theory, further development of the general theory of gauge models, both in the context of quantum electrodynamics and non-Abelian gauge theories, and further refinement of theorems on the inconsistency of theories of particles of spin greater than or equal to 3/2 in external fields.

This work represents a continuation of that currently supported by Foundation grant PHY74-22844 A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0022, ENERGY TRANSFER MECHANISMS IN MATERIALS STUDIED BY ULTRAFAST LASER TECHNIQUES
R.R. ALFANO, City University of New York, School of Liberal Arts & Sci., *New York, New York* 10031 (ENG76-80212)

A research program will investigate intermolecular energy transfer between donor and acceptor molecules in liquids and solids using ultrafast laser spectroscopy. The program encompasses a systematic study of measuring the fluorescence and absorption kinetics from the different molecular components after optical excitation of one molecular component by picosecond laser pulses. Fluorescence kinetics from upper singlet states will be studied. Organic dyes mixtures in solvent and doped organic crystals at different concentration of donors and acceptor molecules will be investigated to determine the mechanisms for energy migration between donor molecules and between donor and acceptor molecules. The temperature and viscosity dependence will be studied to yield this information. The energy transfer along long donor molecule chains will be studied. The characterization of energy migration of exicted states in solids and liquids is important in the understanding on how to transfer optical energy to different spectral regions.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

8.0023, RESONANCES UTILIZING MULTIPARTICLE SPECTROMETERS
S.J. LINDENBAUM, City University of New York, School of Liberal Arts & Sci., *New York, New York* 10031 (PHY77-20225)

Investigations of the production of resonance states in hadron-proton collisions will be conducted in collaboration with research groups from Brookhaven National Laboratory, Brandeis, Massachusetts, and Cincinnati using the multiparticle spectrometer at the Brookhaven Alternating Gradient Synchrotron.

The program consists of two parts: 1. Search for charm particle production. This experiment, if successful, would demonstrate associated charm particle production and would show that selection rules for charm and strangeness quantum numbers are similar. Fifteen to 20 GeV pi meson interactions in hydrogen are studied. 2. Search for additional conventional resonances in the 1 to 3 GeV mass range. This experiment explores with high statistics the many particle final states in the energy range of 1 to 3 GeV produced in 6 GeV K-interactions in hydrogen.

This work represents a continuation of that currently supported by Foundation grant PHY73-04384 A02.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0024, LIGHT FLASH PHENOMENA INDUCED BY HZE PARTICLES
P. MCNULTY, Clarkson College of Technology, School of Arts & Sciences, *Potsdam, New York* 13676 (NSG 9059)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0025, SPACE PROCESSING CRYSTAL GROWTH FROM THE VAPOR PHASE
H. WIEDEMEIER, Rensselaer Polytechnic Inst., School of Science, *Troy, New York* 12181 (NAS 8-32639)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0026, MOLECULAR MOTION AND NUCLEAR MAGNETIC RELAXATION
P.S. HUBBARD, Univ. of North Carolina, School of Arts & Sciences, *Chapel Hill, North Carolina* 27514 (DMR73-02626 A03)

Theoretical research on the following topics involving molecular motion and spin relaxation will be carried out. (1) Continuation of the development of the Langevin model of rotational Brownian motion, including calculations of the motion and nuclear magnetic relaxation of nonspherical molecules, and comparison of calculated and experimental results. (2) Investigation of questions arising in connection with some calculations of molecular motion employing Zwanzig- and Mori-type projection operators. (3) Applications of the Argyres and Kelley theory of spin relaxation to situations which cannot be adequately described by the Bloch-Redfield theories.

This is a continuation of research supported under DMR73-02626.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0027, ANALYTICAL METHODS IN PARTICLE TRANSPORT THEORY
C.E. SIEWERT, Univ. of North Carolina, School of Engineering, *Raleigh, North Carolina* 27607 (ENG77-09405)

The method of elementary solutions will be used to study several basic problems in the area of 'particle' transport theory. Three basic problems are considered in establishing analytical approximations for engineering applications. In particular, the problem of radiation in multi-media arrangements will be considered for both the grey case and the general N group picket-fence model. Also the matrix Riemann problem basic to multigroup transport theory will be studied and used to define the various H matrices so that the solution to typical half-space problems in multigroup theory, with anisotropic scattering, will be expressed concisely. If the H matrices can be expressed in terms of canonical solutions to the Riemann problems, then the character, regarding real and complex values, of the H matrices for multiplying media can be determined, and the H matrices can then be used to establish a sound basis for analytical approximations, in addition to rigorous results. In addition to the work on neutron-transport theory and radiative heat transfer, a study of sound-wave propagation in a rarefied gas will be undertaken. Here, since time dependence is required, a theory for the case that the elementary solutions contain complex parameters will be considered and the subsequent theory of the H matrix developed.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

8.0028, RADIATION-INDUCED VOIDS BY POSITRON ANNIHILATION
J.D. MCGERVEY, Case Western Reserve Univ., Graduate School, *Cleveland, Ohio* 44106 (DMR74-07190 A01)

Studies of radiation-induced voids and other defects in metals using measurements of positron lifetimes and the angular correlation of positron annihilation radiation from these metals which were previously supported by DMR74-07190 will be continued. The research will be done in collaboration with members of the Radiation Effects and X-ray Diffraction Groups of the Metals and Ceramics Division of Oak Ridge National Laboratory, who irradiate the samples and also study them by means of small-angle X-ray scattering and transmission electron microscopy. Attempts will be made to: Clarify the effects of annealing; Observe the effect of voids of different sizes by varying the neutron fluence, and; Observe the effect of silicon impurities in Al and Al alloys by studying alloys such as Al-Mg and by irradiating samples surrounded with thermal neutron absorbers to decrease the production of Si.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0029, MEDIUM-ENERGY NUCLEAR PHYSICS RESEARCH
H.B. WILLARD, Case Western Reserve Univ., Graduate School, *Cleveland, Ohio* 44106 (EY-76-S-02-2146)

Our LAMPF Users Group is continuing the investigation of the proton-proton interaction by the method of polarized beams and targets. Triple scattering, and spin correlation parameters are planned to be measured in the renewal period. This series of experiments is intended to shed light on the strong nuclear force, the spin dependence of the interaction, and symmetries involved. Polarization in p-D elastic scattering will be studied. Asymmetries in pion production produced by a polarized proton beam and liquid hydrogen target are planned to be investigated. In addition, we plan to investigate few nucleon systems by observing pi zero particles in the final state. Supporting instrumentation and techniques are part of the program.

RESULTS: Single and double pion momentum spectra have been observed for pp collisions at 800 MeV. Total reaction cross sections on carbon, three calcium isotopes, and lead have been measured. The polarization analyzing power of proton-proton elastic scattering at 800 MeV has been studied. Preliminary results for the Ayy(theta) spin correlation parameter in p-p elastic scattering have been obtained. Progress on the pi zero spectrometer continues.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of High Energy & Nuclear Physics

8.0030, THEORETICAL STUDIES OF NUCLEAR STRUCTURE AND NUCLEAR REACTIONS
N. AUSTERN, Univ. of Pittsburgh, School of Arts & Sciences, *Pittsburgh, Pennsylvania* 15260 (PHY76-81104 A01)

Theoretical research on nuclear structure and reactions and related studies of medium-energy meson-nucleus processes and of multiple scattering theory initiated under NSF grant PHY75-01397 AO1 will be continued.

The nuclear structure work emphasizes a large-scale study of properties of the shell-model effective interaction, derived by the systematic selection of a limited part of Hilbert space. Careful study is given to the singularities of this effective interaction. Techniques for overcoming these singularities and for other improvements to the effective interaction are being developed.

A vigorous program in 'medium-energy nuclear physics' will be continued. Computer codes developed for meson-nucleus collision studies have been improved and generalized so they can be used more conveniently at Pittsburgh and made available to others. Applications to kaon scattering are under way, as are studies of mesic atoms and of pion photoproduction and capture. Much of this work is in collaboration with experimental groups at Carnegie-Mellon University and at LAMPF. Other medium-energy work concerns fundamentals of multiple scattering theory, with particular attention to corrections to closure and to the impulse approximation.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0031, AN INVESTIGATION OF VIBRATIONALLY EXCITED IONS OF AERONOMIC IMPORTANCE
E.C. ZIPF, Univ. of Pittsburgh, School of Arts & Sciences, *Pittsburgh, Pennsylvania* 15260 (ATM74-23426 A01)

This grant funds an investigation of the production, relaxation, and dissociative recombination of vibrationally excited ions of aeronomic importance. In particular, it funds: 1. a continuation of studies of the dissociative recombination of vibrationally excited CO2 plus ions, with particular emphasis on high-resolution spectral measurements and on detailed studies of the specific recombination coefficients as a function of the electron temperature. 2. A study of the dissociative recombination of N2O ion and NO2 ion, to see if this may be the source of the anomalous auroral emission feature at 2150 A, and 3. A measurement of the absolute rate of formation of N2O and N2O ion from the reaction of metastable N2 with O2 and O.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

8.0032, INTERACTION OF SLOW ELECTRONS WITH HIGH-PRESSURE GASES ('QUASI-LIQUIDS') - SLOW ELECTRON-MOLECULE INTERACTIONS (ABBREV)
L.G. CHRISTOPHOROU, Univ. of Tennessee, School of Liberal Arts, *Knoxville, Tennessee* 37916 (E(40-1)-4703)

Our work on the interaction of slow electrons with molecules in dense gases will continue with emphasis on atmospheric pollutants such as CO2, H2S, NO2. Accurate measurements of the rates and the cross sections for attachment of slow electrons to molecules at various pressures and in various media will provide effective ways to elucidate the collision kinetics of electron-molecule interaction processes. Such information is necessary for understanding physicochemical reaction pathways in the atmosphere and helpful in unifying the modeling of gas-phase phenomena with those in the condensed phase. In addition, knowledge on slow electron-molecule interactions, especially on negative-ion states, is synthesized.

RESULTS: CO2 has been found to attach slow (less than or equal 0.5 eV) electrons in mixtures with high-pressure nitrogen. On the basis of electron mobility measurements in gaseous and in liquid CH4 and Ar, the monentum transfer cross section, sigma m, for these molecules has been shown to exhibit a Ramsaurer-Townsend minimum at all densities from the dilute gas to the

liquid. From the variation of electron drift velocity with temperature it has been shown that there is a similar minimum in sigma m, for neopentane at approximately 0.15 eV. A close similarity has been found to exist in the relative position of the energies of the occupied pi-orbitals and the observed negative-ion resonances for aromatic molecules. From a systematic study of negative ion states of atoms and small molecules a semiempirical scheme has been developed which allows prediction of electron affinities of atoms and small molecules from a knowledge of the ground-state ionization energy, or the term value for the Rydberg state.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Biomedical & Environmental Research

8.0033, STUDY OF NEUTRON-PROTON INTERACTION IN THE 300-700 MEV ENERGY REGION
L.C. NORTHCLIFFE, Texas A & M University System, School of Science, *College Station, Texas* 77843 (EY-76-S-05-4449)

The objectives of this work are: to determine the spectrum of neutrons produced in 500-800 MeV proton bombardment of deuterium and other light elements; to use the most suitable reaction for the development of monoenergetic neutron beams needed to study the neutron-proton interaction in the 500-800 MeV energy region; to measure the differential cross sections for elastic neutron-proton scattering and for pion production in neutron-proton collisions at 500-800 MeV; to measure the neutron-proton total cross section at 500-800 MeV; to measure the neutron-proton polarization and spin-correlation parameters at 500-800 MeV. These measurements will constitute a complete determination of the neutron-proton interaction in that energy region, realizing one of the fundamental goals of intermediate-energy physics. The 500-800 MeV neutron beams will also be used to study the spectra of charged particles produced in neutron bombardment of various nuclei. The experiments will be carried out at the Los Alamos Meson Physics Facility using a magnetic spectrometer, multiwire proportional counters, scintillation counters, a polarized hydrogen target, and other appropriate instrumentation.

RESULTS: Differential cross section for np elastic scattering and angular distribution for np d P at 463,647 and 800 MeV; cross sections for np charge-exchange and nD back-angle elastic scattering at 200-800 MeV; cross sections for np positive pion and negative pion at 800 MeV; neutron spectra from 647 and 800 MeV proton bombardment of 1H, 2H and various solid targets; p and d spectra from 800 neutron bombardment of various targets.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of High Energy & Nuclear Physics

8.0034, SPIN DEPENDENCE OF ION-ATOM COLLISIONS AND HYPERFINE STRUCTURE OF SIMPLE IONS BY REORIENTATION SPECTROSCOPY OF STORED IONS
H.A. SCHUESSLER, Texas A & M University System, School of Science, *College Station, Texas* 77843 (PHY76-81827)

Novel experimental studies of the dependence of ion-molecule reactions and ion-photon processes on the orientation of the collision partners are being developed. Spin-dependent charge transfer reactions, spin exchange collisions, and spin-dependent rearrangement reactions will be explored. There is no existing experimental work on the electron spin dependence of charge transfer and rearrangement collisions, although it is generally recognized that spin is an important parameter. The proposed investigations of the basic aspect of ion molecule collisions will employ ion storage techniques. In such an experiment, polarized ions can be produced, stored for many minutes in ultrahigh vacuum, and nondestructively interrogated as to their spin state, after the collision of interest has taken place. Emphasis is placed on the study of simple systems, such as collisions between He ion, Hg ion, and Ba ions and polarized alkali and hydrogen atoms. Three series of experiments, all of which require the containment of charged atomic systems without loss of spin orientation, are planned.

After containment is accomplished, various reorientation collision schemes involving beams of oriented atoms, intense tunable laser light, and suitably chosen radio-frequency fields, are applied, and the reaction processes of interest are studied.

Simultaneously with the collision studies described, spectroscopic data of stored ions will be measured with high precision.

Additional experiments will measure the g-factors of He ion, Hg ion, and H2 ion in the ground state in an effort to compare these gj-factors with that of the free electron, measured in the same apparatus. The result will test the well-known relativistic Breit correction, which so far has not been observed directly.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0035, INTEGRATED THIN FILM DC SQUIDS
G.B. DONALDSON, Univ. of Strathclyde, *Glasgow, Scotland, United Kingdom* (DA0C9487; DAERO 77 G0001)

It is intended to explore dc SQUID fabrication using surface physics techniques, to develop in particular a new type of magnetic gradiometer, and to study complex junction structures.

Current SQUID systems present problems because a) they use rf biasing, which can lead to inconvenience in cryostat design, b) they are bulk, point contact structures which involve adjustments to make them operate and complex trimming operations when they are to be used in balanced magnetic measurements, such as gradiometry. Recent developments with double-junction interferometers (dc SQUIDS), however, seem likely to overcome some of these difficulties, and make dc SQUID production easier. It is planned to use ellipsometry and other surface analysis techniques to study the surface conditions and other properties necessary for controlled oxide growth in tunnel junctions. It is intended to develop new integrated gradiometer structures with a view to achieving not only better resolution, but also devices which measure other components of gradient or higher differentials of the field.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Research & Standardization Group

8.0036, TOPIC IN THE THEORY OF TRANSITION-METAL SURFACES AND APERIODIC MATERIALS
J.J. REHR, Univ. of Washington, School of Arts & Sciences, *Seattle, Washington* 98105 (DMR76-82112)

Three theoretical research projects will be carried out: 1) A new technique for calculating electronic structure in non-periodic solids will be developed. Applications will include calculations of the surface d-electron density in the noble and transition metals and semi-self-consistent calculations of the density of states in transition metal oxides. 2) Analytical studies will be carried out aimed at answering two fundamental questions concerning surface electronic structure: a) How quickly does the electron charge density reduce to its bulk behavior away from a surface? and b) What is the Van Hove singularity structure in the surface densities of states? 3) The third part deals with the theory of extended X-ray absorption fine structure (EXAFS), a new experimental technique for determining local structure in non-periodic materials. Many-body corrections will be studied and calculated. This study should improve experimental determinations of coordination numbers using EXAFS.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, ZEEMAN AND CONTINUUM POLARIZATION STUDIES OF MAGNETIC WHITE DWARF STARS AND OTHER OBJECTS
J.R. ANGEL, Univ. of Arizona, School of Liberal Arts, *Tucson, Arizona* 85721 (AST75-17845 A02)

In the past year magnetic white dwarf stars have been found which are in binary systems. Observations of these stars will be made in order to study the effects of magnetic fields on the transfer of matter to the white dwarf star. Optical surveys for other such objects will be made using data provided by the NASA High Energy Astronomical Observatory satellite HEAO-A.

A new white dwarf star having a very strong magnetic field has been discovered within the last year (LP 790-29). This will be studied in order to determine the effects of strong fields on the spectrum of the star. In addition, photometric and spectroscopic observations of very blue stars in young stellar clusters will be made in order to confirm their identification as white dwarf stars.

Polarization studies will be made of the light emitted from the nuclei of Seyfert galaxies. The emphasis here will be on the time-variability of this polarization. There will also be a polarimetric survey of the sky for diffuse objects (such as galaxies) which show strong polarization.

This research grant is a continuation of work previously supported by NSF grant AST75-17845A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0002, OPTICAL OBSERVATIONS OF CELESTIAL X-RAY SOURCES

C.S. BOWYER, Univ. of California, School of Letters & Science, *Berkeley, California* 94720 (AST75-03735 A01)

X-ray astronomy is one of the newest fields of astronomical research, partly because it can be conducted only from above the Earth's atmosphere and partly because only now is our technology sufficiently developed to fully exploit this field. The most startling discovery in this field is that our Milky Way Galaxy contains objects emitting intense quantities of X-radiation but very little visible light, which is the opposite of the case of our own Sun and most other stars. Our understanding of these objects is preliminary, but it appears that many of them are compact stars such as white dwarfs, neutron stars, and black holes, in extremely advanced stages of evolution. Improved locations for these sources, obtained recently from satellite-borne experiments, have enabled us to identify and study several of their faint optical counterparts. The study of optical counterparts of the first known extrasolar extreme ultraviolet (EUV) sources has begun. The nature of these sources is virtually unknown, as no EUV sources were known to exist until they were discovered on the Apollo-Soyuz mission last year. Studies of the visible light emitted by X-ray and EUV objects will be carried out, using the most advanced optical technologies currently available. These studies will add greatly to our understanding of these systems and the final stages of stellar evolution.

This is a continuation of work previously supported by NSF grant AST75 03735.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0003, PHOTOCHEMISTRY OF THE JOVIAN PLANETS AND THEIR SATELLITES

Y.L. YUNG, Calif. Inst. of Technology, Graduate School, *Pasadena, California* 91109 (NSG 7376)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0004, RESEARCH IN THE CIRCULATION OF THE SOLAR ATMOSPHERE

H. ZIRIN, Calif. Inst. of Technology, Graduate School, *Pasadena, California* 91109 (ATM76-21132 A01)

This grant will support a general program of research in solar physics at the Big Bear Solar Observatory, Pasadena, California. Particular subjects to be attacked are: 1. The fine structure of the solar chromosphere; its evolution and connection with magnetic fields. 2. The solar granulation, brightness, fluctuation and lifetime of granulation and the connection of granulation with chromospheric structure. 3. The evolution of weak magnetic fields on the surface of the sun. 4. Coronal holes as observed through optical phenomena. 5. Solar rotation, as measured by rotation of surface features. 6. Solar activity and solar flares; the development of solar active regions, evolution of solar magnetic fields, oscillatory phenomena in sunspots, and the three-dimensional structure of active region fields. 7. Comparison of optical and high-energy data. 8. Measurement of the solar constant with a cavity radiometer. 9. Quantitative measurement of filtergrams. 10. Measurement of plage brightness at the extreme limb.

The general aim of this grant is to further our understanding of solar-terrestrial relations by the analysis of high-quality photographic data on solar activity.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

10.0005, A CHARGE COUPLED DEVICE CAMERA FOR ASTRONOMY

F.P. LANDAUER, U.S. Natl. Aero. & Space Adm., Jet Propulsion Laboratory, *Pasadena, California* 91109 (AST77-20893)

A new Charge Coupled Device camera will be made available to several observatories during the course of the coming year. The camera has 400 by 400 picture elements, extended spectral range, good linearity and dynamic range, and a quantum efficiency of 70%. This represents a significant advance in capability. The camera will be used on a wide variety of programs involving both direct imaging and spectroscopic observations of planets, stars, and galaxies.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0006, A STUDY OF THE FLARE STAR PROXIMA CENTAURI

J.L. LINSKY, Univ. of Colorado, School of Arts & Sciences, *Boulder, Colorado* 80302 (NSG 5211)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0007, INVESTIGATION OF THE LONAR CRATER, INDIA

K. FREDRIKSSON, Smithsonian Institution, *Washington, District of Columbia* 20560

The Lonar crater is of particular interest because it is located in the vast deccan basalt area and recent results of the U.S. Apollo missions to the moon indicate that large parts of the lunar surface are of basaltic composition. Drilling and trenching in and around the structure has been initiated by the Geological Survey of India and is continuing. Examination of the material recovered from this program has been initiated in our laboratory. Particular emphasis is being placed upon critical comparisons of the Lonar material with selected lunar material returned by the Apollo program.

SUPPORTED BY Smithsonian Institution, Museum of Natural History

10.0008, THE GRAVITATIONAL COLLAPSE OF STARS AND NUCLEAR ASTROPHYSICS

W.D. ARNETT, Univ. of Chicago, Graduate School, *Chicago, Illinois* 60637 (AST76-20253 A01)

Topics in five areas of astrophysics will be investigated: 1) gravitational collapse, 2) stellar evolution, 3) nuclear astrophysics, 4) supernovae, and 5) galactic evolution. The problems of the physics of gravitional collapse, the nature of the remnants left by the process, the nature of the pregenitors and their evolution, and the ejection of matter and its composition will receive attention. There will be calculations of asymmetric stellar explosions. The evolution of neutrino stars (hot neutron stars), with an examination of their stability, will be carried out. There will be calculations of spherically symmetric stellar explosions in order to determine the mass of the neuron star or black hole remnant. Calculations will be made of the abundances of material ejected by the supernova explosion.

This research is a continuation of work previously supported under NSF grant AST76-20253.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0009, GRAVITATIONAL PHYSICS AND RELATIVISTIC ASTROPHYSICS
S. CHANDRASEKHAR, Univ. of Chicago, Graduate School, *Chicago, Illinois* 60637 (PHY76-81102 A01)

Research on a broad range of topics in theoretical relativity and relativistic astrophysics initiated under NSF grant PHY74-17456 AO2 will continue. Specific topics of investigation will include: Chandrasekhar: 1. Solution of linearized perturbation equations for the Kerr Metric. 2. Dirac equation in Kerr geometry. Geroch: 1. Counterexamples to the Hopf conjecture. 2. Reasonableness of definition of 'asymptotic simplicity' for fields in space-time. 3. Description of singularities in general relativity. Ipser: 1. Construction and stability of differentially rotating relativistic models of fully relativistic fluid bodies. 2. Distribution of stars around a black hole located at the center of a cluster. Wald: 1. Effective stress-tensor for particles created by a strong gravitational field. 2. Back reaction of particle production upon black holes or cosmological evolution.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

10.0010, INVESTIGATION OF MICROSCOPIC AND MACROSCOPIC PLASMA PROPERTIES WITH APPLICATION TO SPACE PLASMAS
G.R. JOYCE, Univ. of Iowa, School of Liberal Arts, *Iowa City, Iowa* 52240 (ATM76-82739)

This grant considers the application of numerical methods and analytical approximations to study the microscopic and macroscopic properties of space plasma systems. Specific areas to be studied include the following: the development and characteristics of potential double layers using solutions of the Vlasov equation and numerical simulations; the formation of double layers in the magnetospheres of Earth and Jupiter and associated particle acceleration and radio emissions; the observable effects of 100 kilovolt electrons and ions accelerated by Jupiter's moon Io; the development of turbulent cascades in magnetohydrodynamic plasmas; and the structure of the Jovian magnetosphere including the cold plasma, the current sheet and the energetic particles.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

10.0011, A COMPLETE SURVEY OF GALAXY REDSHIFTS TO MV EQUALS 14.5 USING A PHOTON-COUNTING DETECTOR ARRAY
M. DAVIS, Harvard University, School of Arts & Sciences, *Cambridge, Massachusetts* 02138 (AST76-22675 A01)

A photon-counting array will be used in a program to measure the redshifts of a complete sample of galaxies to a limiting magnitude of approximately 14.5. The resulting catalog of redshifts will provide unique data for research in extragalactic astronomy. Intended uses of the catalogue include: 1) Direct measurement of the galaxy-galaxy covariance function using the redshift as a distance indicator; 2) Improved determination of the luminosity distribution of galaxies and hence of the luminosity density of galaxies; 3) Improved understanding of the dynamics of galaxies within approximately 50 megaparsecs of the Milky Way. These questions are of direct relevance to the issue of whether the Universe is closed or open, and the results of the survey will play an important role in resolving the issue.

This is a continuation of research done under grant AST 76-22675.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0012, STELLAR PHYSICS - RADIATION TRANSFER
E.H. AVRETT, Smithsonian Institution, *Cambridge, Massachusetts* 02138

Development of numerical methods for the solution of the equations of statistical equilibrium and the equation of radiative transfer in spectral lines and in continua.

Application of the numerical methods to solar and stellar lines of multi-level atoms, especially in a study of the chromospheric structure of the sun.

Investigation of the properties of radiation emerging from stochastic media, and media exhibiting horizontal structure.

Study of deviations from local thermodynamic equilibrium in stellar photospheres.

Determination of the source function from observations of solar lines by means of an inversion of the Laplace transform.

Development of methods for correcting observed spectral profiles for instrumental broadening and noise.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0013, METEORS
A. COOK, Smithsonian Institution, *Cambridge, Massachusetts* 02138 (31P-4P50-01)

Planetary Studies: Dr. Cook's research has yielded three completed studies which are being prepared for publication. The first of these is an interpretation of the failure to observe Saturn's rings in radio emission at wavelengths longer than 2mm although they are seen in absorption against the disk out to 3.7cm and in back-scattered radar reflection at 12.6cm. The second is a study of the predicted toroid of atomic hydrogen around Titan's orbit. The third is a study of the kinetics of collisions among particles in the rings. For the rings, snowballs of methane clathrate hydrate, ammonium hydrate and water ice with radii about 5cm are required to explain the observations. For Titan's toroid, there is little likelihood that much atomic hydrogen is there. Study of the kinetics of the rings indicates that the frequency of collisions must be very low (of the order of the libration periods for resonances with Mimas, or one per decade) and that the thickness of the rings is comparable to or less than the interparticle distance. Dr. Cook and Dr. Franklin are preparing a paper concerning the absence of a ring about Uranus.

Meteors: Dr. Cook completed his editorial duties on the volume for IAU Colloquim No. 13 with Prof. Hemenway (Dudley Observatory) & Dr. Millman (National Research Council) which has appeared. Dr. Cook and Dr. Millman have commenced a spectrophotometric analysis of the National Research Council of Canada's brightest observed Perseid. Dr. Cook, Prof. Hemenway & Dr. Millman have been preparing for a new observing program using new televison equipment for study of spectra of faint meteors to be carried out jointly with the Dudley Observatory and the National Research Council of Canada.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0014, ATMOSPHERIC PHYSICS STUDIES
A. DALGARNO, Smithsonian Institution, *Cambridge, Massachusetts* 02138 (144225-31A)

Computations for quantum mechanical calculations of the transition moments of molecular oxygen.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0015, FLIGHT INFRARED ASTRONOMY
G. FAZIO, Smithsonian Institution, *Cambridge, Massachusetts* 02138 (31S-4S50-05)

In cooperation with Harvard College Observatory and the University of Arizona, a 40-inch telescope was constructed, to be launched on a high-altitude balloon, to investigate the far-infrared spectrum of celestial sources. The successful flight was completed on 3 February 1974, from Palestine, Texas. The telescope, weighing 4000 pounds, was carried by a 5-million-cubic-ft balloon to an altitude of 90,000 feet, where it was commanded remotely from the ground to make infrared maps of NGC 7538, Mars, Orion A, and W3. Angular resolution of 1 arcmin was achieved, in the wavelength range 40-150 microns. Signals were very clear, and numerous small sources were seen in addition to those listed above. Instrument development continues and more flights are planned.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0016, MODEL ATMOSPHERES
R. KURUCZ, Smithsonian Institution, *Cambridge*, *Massachusetts* 02138 (31S-4S50-03)

Analysis of solar photospheric rocket spectra of W. Parkinson, E. Reeves, and J. Kohl. The stages of the analysis are definition of a wavelength scale, identification of the lines, and finally comparison of the predicted intensities to those observed. Information should be forthcoming on the reliability of gf values, damping constants, photoionization cross sections, abundances, solar models, and the rocket calibration.

Through spectral synthesis the analysis of rocket and satellite data for early stars was found to be much more complicated than has been generally assumed. Many of the observed features are, in fact, blends of a number of lines, so that simple analysis in terms of equivalent widths is not possible and detailed spectral synthesis is required.

A preliminary theoretical solar model photosphere was published and work is continuing on improving the line data which goes into the calculation.

In collaboration with J. Lester and A. Dupree, analysis of their stellar observations from the Copernicus satellite. Also guest investigator on Copernicus for observations of Vega and Sirius.

Production of a grid of line-blanketed model atmospheres for F, A, B, and O stars for a range of gravities down to the radiation pressure limit, for abundances 10, 3 1, 1/3, 1/10, 1/30, and 1/100 solar, and for a range of microturbulent velocities. These models will be used to determine the variation of any observable quantity (colors, energy distributions equivalent widths, line profiles) with temperature, gravity, abundance, and microturbulent velocity. These models should resolve differences between galactic clusters, microturbulence in A stars, metallicity, and population differences.

Research on gf values for the iron group, gf values for interstellar lines, and a gf value compendium (with E. Peytremann).

Research on several aspects of the problems associated with calculating realistic line-blanketed model stellar atmospheres.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0017, STELLAR SPECTROPHOTOMETRY
D.W. LATHAM, Smithsonian Institution, *Cambridge*, *Massachusetts* 02138 (310-4050-08)

This is research in stellar spectroscopy. Part of it is medium-resolution high-accuracy spectrophotometry between 3200 and 10,800A, including a new absolute flux calibration of Vega. Part is high-resolution spectrophotometry using an echelle spectrograph. Recent efforts have centered on the microphotometry of echellograms and abundance analyses.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0018, THE EVOLUTION OF SELF-GRAVITATING SYSTEMS
M. LECAR, Smithsonian Institution, *Cambridge*, *Massachusetts* 02138 (SFC 8 7006)

With the aid of computer simulation, the nonlinear dynamical evolution of Clusters of Galaxies and of Globular Clusters is being studied. In the case of Clusters of Galaxies, an attempt to find the 'missing mass' is being made by investigating the result of different forms of the 'missing mass' on the density distribution of the cluster. The difference between the observed mass and the amount needed to stabilize the cluster is approximately a factor of 10, and constitutes the amount of mass needed to 'close' the Universe.

In the case of Globular Clusters, an attempt is being made to answer the question: why, in contrast to elliptical galaxies, which otherwise resemble these clusters, are the clusters predominantly round?

SUPPORTED BY Smithsonian Institution, Office of International Programs

10.0019, GALACTIC DYNAMICS - CELESTIAL MECHANICS - SOLAR SYSTEM DYNAMICS
M. LECAR, Smithsonian Institution, *Cambridge*, *Massachusetts* 02138 (31T-4T50-02; 03; 04)

Drs. Lecar and F. Franklin continued their study of the dynamical evolution of the asteroid belt. Orbits between 3.3 and 4.0 AU were found to be stable for thousands of years, but this region is unpopulated in the solar system. They are now studying the very long term perturbations of Jupiter. W. Wiesel, a doctoral student of Lecar, established that Jupiter's resonant perturbations produced gaps in the asteroid belts at the observed locations, but concluded that an additional mechanism, such as collisions, is required to clean out the gaps.

Lecar studied the tidal circularization of close binary stars. With J.C. Wheeler and C. McKee, they were able to satisfactorily explain the observed low eccentricity of the binary X-ray source Hercules X-1. However, they concluded that the source in Centauris X-3 is probably spiralling into the primary.

With G. Mybicki and M.M. Schaefer, Lecar completed a study of the rotation curves of spiral galaxies. They concluded that a substantial mass could exist exterior to the measured rotation curves without distorting those curves. This rationalized the 21 cm observations of M. Roberts at NRAO who found that this was the case in the nearby galaxy Andromeda.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0020, AN ASTRONOMICAL OBSERVING PROGRAM IN ISRAEL
M. LECAR, Smithsonian Institution, *Cambridge*, *Massachusetts* 02138 (SFG 0 3005)

An observatory has been constructed and instrumented and is now operating in the Negev desert in Israel. The observatory is jointly financed by Tel Aviv Univerity and the Smithsonian Institution; 50% of the observing time is reserved for US observers. The observations were made at the Israeli site (in connection with the moon, and with X-ray observations of SCO-XR-1). The major instruments at this new observatory are: a 40 inch wide-field telescope manufactured by Boller & Chivens, a photometer made at CalTech, and an image tube spectrograph made by Boller & Chivens. Currently under design is a Videcon System to be made by Bell Labs, Princeton University Observatory and the Beta Company in Israel. The observatory was dedicated in October 1971, and a number of cooperative observing programs are underway.

Plans have been drawn for the last major instrument - a digital (TV) camera and the process of negotiating its fabrication at the University of Texas has begun. The estimated completion data is June 1975. During the past year, there were some interruptions in the observing schedule, but the astronomers did produce an additional dozen research contributions including an unambigious determination of water in Comet Kohoutek.

SUPPORTED BY Smithsonian Institution, Museum of History & Technology

10.0021, MILLIMETER WAVE TELESCOPE
A.E. LILLEY, Smithsonian Institution, *Cambridge*, *Massachusetts* 02138 (31R-4R50-03)

Study program for the construction of a new millimeter wave radio telescope, establishment of design goals and preliminary contact with designers and builders.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0022, TIME OF CRAB OPTICAL PULSAR
C. PAPALIOLIOS, Smithsonian Institution, *Cambridge*, *Massachusetts* 02138 (31H-4H50-00/04; SRF 430064)

Observations of the Crab Nebula pulsar are made to gather sufficient data for an understanding of the dynamics of rotating neutron stars and of the reasons for their occasional departure from a smooth secular slowdown. In addition, searches were conducted for new optical pulsars.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0023, LIGHT SOURCE PROJECT
W. PARKINSON, Smithsonian Institution, *Cambridge, Massachusetts* 02138 (31A-4A50-02)

Initiated plans to extend our atomic and molecular spectroscopy program to include quantitative measurements of the basic parameters of highly ionized atoms such as excited-state lifetimes, fluorescence decay branching ratios, wavelengths and collision and absorption cross sections. Initiated this work with a program to develop a new spectroscopic source of multiply ionized atoms that will possess several unusual features that are expected to eliminate many of the uncertainties that are associated with the more conventional sources. The new device will be built around a high-current hot-cathode oscillatory discharge ion source that was developed by G.S. Mavrogenes, W.J. Ramler and C.B. Turner at the Argonne National Laboratory as an adjunct to the design of a high-power heavy-ion cyclotron.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0024, CONTINUATION OF THE UTTAR PRADESH STATE OBSERVATORY/SMITHSONIAN ASTROPHYSICAL OBSERVING STATION AT NAINI TAL, INDIA
G.C. WEIFFENBACH, Smithsonian Institution, *Cambridge, Massachusetts* 02138 (FR5-46242)

SAO operates a network of astrophysical observing stations under NASA Satellite-Tracking Program Grant NGR 09-015-002 to track satellites in support of SAO and NASA research programs. The network has provided data for geodesy, geophysics and celestial mechanics since 1958. Observational data for comet and flare-star research have also been provided.

In geodesy and geophysics, the data are being used at SAO to develop accurate mathematical descriptions of the earth's size, shape, and gravity field. This information is fundamental to the understanding of the composition and structure of the earth. Models developed and published by SAO are used by investigators in geodesy and geophysics around the world as standard references. As a part of the NASA-sponsored Earth and Oceans Physics Applications Program (EOPAP), we are now embarking on a new program to measure the dynamic properties of the solid earth and the oceans.

Under this program, phenomena such as crustal and polar motion, earth and ocean tides, earth rotation, and ocean surface topography will be measured with satellite techniques to support research in earthquake mechanisms, earth crustal structure, ocean circulation, and the general air-sea interaction, which has a large influence on weather and climate.

In atmospheric research, the data are used to develop models of upper atmospheric densites, composition, and dynamic properties. These models are also used world-wide as standard references by investigators in atmospheric physics, solar physics, and the many areas in space science.

The data have revealed correlations between solar activity and satellite drag, caused by solar heating of the upper atmosphere, that show that atmospheric density variations are related to a number of separate but related solar phenomena.

Because of its worldwide distribution and unique optical equipment, the network has been able to support research in flare stars, comets, and other astronomical phenomena.

The station at Naini Tal, India, is one of the SAO network's 11 photographic observing sites. Because of its geographical location this station is a unique and valuable source of observational data for the global network. It has been operated in cooperation with the Uttar Pradesh State Observatory since 1958.

SUPPORTED BY Smithsonian Institution, Office of International Programs

10.0025, ANALYSIS OF FLARE-STAR OBSERVATIONS
F.L. WHIPPLE, Smithsonian Institution, *Cambridge, Massachusetts* 02138 (SFG 0 6425)

The Uttar Pradesh State Observatory (UPSO) in Naini Tal, India, is analyzing and reducing approximately 500 film exposures of suspected flare stars taken by Baker-Nunn cameras at eight SAO stations.

The reduction of the Baker-Nunn photographs is intended to yield brightness data on various flare stars, which, when combined with simultaneous radio-frequency observations and multicolor photoelectric observations, will result in information such as spectral-energy distribution, light curves, and total energy release of stellar flares.

SUPPORTED BY Smithsonian Institution, Office of International Programs

10.0026, STELLAR PHYSICS
C. WHITNEY, Smithsonian Institution, *Cambridge, Massachusetts* 02138 (31S-4S50-04)

I have recently initiated a theoretical and observational program on extended stellar atmospheres, their structure and stability. Using a very general non-LTE atmosphere, I have begun a study of the thermal stability of the solar chromosphere and the atmospheres of B stars. My immediate purpose is to correct a substantial error in the latest published study of this problem by including the effects of radiative ionizations and departures from pure radiative equilibrium.

I am preparing an observational program to collect spectrum data on shell stars and binary systems containing a B star and an M supergiant (VV Cephei systems). These data will be analysed with the non-LTE program.

In a related program, I am examining thermal dissipation through tidal distortion in close binary systems.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0027, STRATOSPHERIC SPECIE MEASUREMENTS AND TECHNIQUES
J.G. ANDERSON, Univ. of Michigan, School of Engineering, *Ann Arbor, Michigan* 48106 (NASW 3065)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0028, STUDIES OF CHEMICALLY PECULIAR STARS
C.R. COWLEY, Univ. of Michigan, School of Lit. Sci. & The Arts, *Ann Arbor, Michigan* 48104 (AST76-20259 A01)

High-resolution studies will be carried out on a large sample of slowly rotating and chemically peculiar stars. The primary emphasis will be on upper main sequence stars, but there will also be studies of stars of later spectral types, including both giant and dwarf stars. Abundance determinations will be made for selected chemical elements of special interest. These studies will be made in order to establish the systematic characteristics of the abundance peculiarities over as wide a range of stars as possible.

This is a continuation of work previously supported by NSF grant AST76 20259.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0029, INFRARED ASTRONOMY
W.A. STEIN, Univ. of Minnesota, School of Liberal Arts, *Minneapolis, Minnesota* 55455 (AST76-21459 A01)

Research directed at obtaining observational results primarily at infrared wavelengths from one micron to millimeter and with the interpretation of these results on a wide variety of astronomical objects will be carried out. Investigations will cover the composition of solid particles in circumstellar and interstellar space, the identification and interpretation of characteristics of objects discovered in infrared sky surveys and the nature of high energetic objects such as QSOs, BL Lac objects and the nucleus of Seyfert Galaxies. Most of the power emitted by many of these objects (galactic and extragalactic) is radiated at infrared wavelengths. The study of this radiation at moderate spectral resolution will lead to identification of discrete spectral features. The interpretation of the spectral flux distribution and variability will lead to further understanding of physical conditions and will complement results obtained by observations at radio, optical and X-ray wavelengths.

This research was previously supported under grant AST 76-21459 for 12 months.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0030, COSMIC-RAY STUDIES
J.E. MCLAUGHLIN, U.S. Energy Res. & Dev. Admin., Radiation Physics Division, *New York, New York* 10014

The relative importance of cosmic-ray contributions to total environmental radiation dose and to detector responses led us to investigate the properties of cosmic rays. Our past measurements near ground level and on high-altitude balloons aid us in interpreting HASL environmental measurements and in testing high-energy transport codes.

RESULTS: The balloon-borne experiments performed until 1973 and the ground-level cosmic rays and accelerator-produced muons have been employed to test computational methods for determining dose.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Biomedical & Environmental Research

10.0031, OBSERVATIONAL AND THEORETICAL STUDIES OF INTERSTELLAR MOLECULAR CLOUDS
P. SOLOMON, State University of New York, School of Arts & Sciences, *Stony Brook, New York* 11790 (AST76-11209 A01)

Observational and theoretical studies of molecular clouds will be carried out in the following areas: 1) Galactic Structure: Kinematics and Mass of Molecular Clouds in the Galaxy and External Galaxies; 2) Astrophysics of Molecular Clouds; 3) Chemistry of the Interstellar Medium; 4) Isotopic Abundances; and 5) Mass Loss from Late Type Stars.

The observations, primarily at millimeter wavelengths, will be carried out principally at the Five College Radio Astronomy Observatory (FCRAO) new 45 ft millimeter wave antenna; the 36 ft antenna of the National Radio Astronomy Observatory, the new 23 ft Bell Laboratories Antenna and the 15 ft University of Texas Antenna. The State University of New York at Stony Brook has provided substantial equipment for the FCRAO antenna and will have about 20% of the observing time available.

Theoretical investigations will concentrate on the physics of dense interstellar clouds and star formation within these clouds, based on a quantitative analysis of the molecular line data. As a result of these investigations significant progress will be made in understanding the role of molecular clouds in stellar and galactic astronomy.

This action provides additional funds and extends the duration of work previously supported under Grant AST 76-11209 for 12 months.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0032, ASTROMETRIC STUDY OF NEARBY STARS
S.L. LIPPINCOTT, Swarthmore College, Graduate School, *Swarthmore, Pennsylvania* 19081 (AST76-21315 A01)

Only in the immediate neighborhood of the sun can the distances, true brightness, and motions of the stars be accurately determined. For binary star systems, which are more numerous than single stars, orbital motion can be derived yielding the masses of the components. Such masses are required by the astrophysicists in their study of the origin, energy production and evolution of the various stellar types. Cyclic deviations in the motions of some of these nearby stars lead to the discovery and study of unseen companion stars, and the potential discovery of planetary companions. The long-range astrometric study of nearby stars from plates taken with the Swarthmore 61 cm refractor has provided a prime source of information about our stellar neighborhood.

Precision astrometric observations will be continued for deriving the distances and motions of nearby stars, and for detecting possible low-mass companions. Also observations will be made of binary systems for the determination of orbital motion and, in favorable cases, the masses of the stars. Special studies will include: a. Better methods of reduction from relative to absolute parallax, b. Photometry of the object and reference stars, c. Evaluation of adjacency and blending effects of close binary components on the photographic plate, d. Continued effort to discover and reduce systematic errors.

Prior support was by NSF grant AST 76-21315.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0033, A MAGNETIC-TAPE CATALOG OF SPECTROSCOPIC AND BIBLIOGRAPHIC STELLAR DATA
S.B. PARSONS, Univ. of Texas, School of Natural Sciences, *Austin, Texas* 78712 (AST76-20254)

The Bidelman file of spectroscopic information and references for about 50,000 stars will be put into machine-readable form at the University of Texas. The file covers much of the astronomical literature and contains much unpublished material not available in other major catalogs.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0034, MILLIMETER SPECTROSCOPY OF INTERSTELLAR MOLECULES
P.A. VANDENBOUT, Univ. of Texas, School of Natural Sciences, *Austin, Texas* 78712 (AST75-22903 A01)

The 16 ft antenna and spectral line receiver of the Millimeter Wave Observatory (MWO) at Mt. Locke (McDonald Observatory) near Ft. Davis, Texas, will be used to observe radio line emission from molecules in dense interstellar and circumstellar clouds. Complementary observations of these molecule line sources will also be made at optical and infrared wavelengths. The observations will yield information about dense interstellar clouds, the physical conditions which accompany star formation, and the spiral structure of the Galaxy. This information will put constraints on the theoretical models of circumstellar masers, and help to determine elemental isotopic abundance ratios throughout the Galaxy which can be compared with theoretical predictions. Millimeter wavelength lines are uniquely suited to serve as probes of dense interstellar matter and the MWO facility is one of only three facilities currently capable of this research. The research will be cooperative in that the MWO facility has been developed and is shared by several active research groups.

This action provides additional funding and extends the duration of the grant number AST77-01490 for 12 months.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0035, GALACTIC ABUNDANCES OF THE CHEMICAL ELEMENTS
P. VENDENBOUT, Univ. of Texas, School of Natural Sciences, *Austin, Texas* 78712 (F-623)

Absorption lines produced by interstellar CH plus free radicals have been measured in the spectra of two nearby stars to determine the value of the isotopic abundance ratio a triple bond 12C/13C for the interstellar material lying within 200 pc of the sun. Failure to detect the 13CH plus component of the 4232 line toward the star 20 Tau together with the strength of the easily observed 12CH plus component toward this star implies a is greater than or equal to 65. The relative strength of the 12CH plus and 13Ch plus lambda 3957 components observed toward the star Oph yields the value of a equals 88(plus31,minus18). The consistency of these values with the terrestrial value of a equals 89 indicates that the chemical abundances of the interstellar material in the neighborhood of the sun have remained undisturbed for the last 4 1/2 billion years. The results also indicate the correctness of recent theories of chemical effects on the abundances of isotopic species of interstellar molecules.

SUPPORTED BY Robert A. Welch Foundation

10.0036, PIONEER VENUS DATA ANALYSIS
J HOFFMAN, Univ. of Texas, Graduate School, *Dallas, Texas* 75230 (NAS 2-9485)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0037, THERMAL HISTORY OF THE INNER PLANETS
J.C. DEBREMAECKER, Rice University, Graduate School, *Houston, Texas* 77001 (NSG 7362)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0038, HIGH-ENERGY ASTROPHYSICS
P.E. BOYNTON, Univ. of Washington, School of Arts & Sciences, *Seattle, Washington* 98105 (AST77-22326)

The variable X-ray and optical source Hercules X-1 (HZ Hercules) is unusual in that it presents many clearly defined periodic phenomena: 1.24 second pulsations, 1.7 day eclipses, and 35 day variations of the X-ray flux. This stellar source is a binary star system, consisting of a relatively low-luminosity star and a compact companion. This compact object is surrounded by a disk of material which is likely to be the cause of much of the observed behavior of this system. Studies will be made of the arrival times of the X-ray pulses both from the point of view of long-term trends and short-term behavior. There will be an investigation of the evolution of the pulse shape and its energy dependence. The accretion disk models will be tested and compared with data presently being obtained with SAS-3 and Ariel V satellites. This will establish the dimensions of the disk, how material is transferred to this disk, and how the disk is maintained. There will also be spectroscopic studies of HZ Hercules.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0039, SPECTROSCOPY OF METAL-POOR SYSTEMS AND STARS SHOWING EVIDENCE FOR THE R-PROCESS
G. WALLERSTEIN, Univ. of Washington, School of Arts & Sciences, *Seattle, Washington* 98105 (AST76-22031 A01)

The chemical evolution of the Galaxy will be investigated by means of studies of selected stars whose ages and positions in the Galaxy are particularly relevant to the problem. The emphasis will be on determining abundance ratios that clarify the rate of build-up of elements produced by different nuclear fusion processes taking place in stars. Studies will include stars which have a low heavy-element abundance. Observations of the Gum Nebula will be made in order to understand the kinematics and physical conditions in this nebula.

This research is a continuation of work previously supported by NSF grant AST76-22031.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0040, HIGH-RESOLUTION SPECTROSCOPIC STUDIES IN AERONOMY
F.L. ROESLER, Univ. of Wisconsin, School of Letters & Science, *Madison, Wisconsin* 53706 (ATM77-20371)

This grant funds continued high-resolution spectroscopic studies of day and night airglow lines in the earth's atmosphere, and of weak absorption lines in the atmosphere of the earth and other planets. A combination of laboratory and field studies are aimed at improved determinations of the (D)/(H) ratio on Jupiter, Saturn and Uranus. The ratio is of cosmological importance, and provides information on the formation of the solar system and the structure of planetary atmospheres. Faint emission lines associated with Io, particularly of KI and SII lines, are also studied for information about the sources and interactions of the emitting atoms, and about the Jovian radiation belts. Geocoronal H alpha and H beta line profiles and intensities are to be measured in order to better understand the motions and excitation of geocoronal hydrogen atoms, and to remove uncertainties in geocoronal intensities determined by means of low-resolution spectrometers or photometers. Other day and night airglow lines should also be studied. Continued instrumented development is also to be pursued.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

GENERAL

11.0001, TO FLY
T.D. CROUCH, Smithsonian Institution, *Washington, District of Columbia* 20560

Project will result in a paper on the early roots of aerostatics, aerodynamics, and rocketry to be presented as the lead-off paper in a symposium offered by UCLA this fall. My paper is to be presented on October 2. The focus is on the scientific background for the key technical innovations leading to successful manned flight. The period covered is roughly 1000 A. D. - 1700 A. D.

SUPPORTED BY Smithsonian Institution, National Air & Space Museum

11.0002, PUBLICATION - AIRCRAFT IN MUSEUMS AROUND THE WORLD
R.C. MIKESH, Smithsonian Institution, *Washington, District of Columbia* 20560

This listing of aircraft in museums is directed toward making greater use of actual specimens for technical and historical research purposes. It is for this exchange of information and specimens that this contains primarily aircraft in museums, though we are aware that many other historical and unique aircraft survive throughout the world.

Periodically, this automatic data process list is updated for information submitted by museums and published for their use.

The 3rd Edition of Aircraft in Museums Around the World was completed and distributed in November 1975. The 4th edition will be completed and distributed in November 1977.

SUPPORTED BY Smithsonian Institution, National Air & Space Museum

11.0003, RESTORATION OF THE AERONCA C-2
J.P. SPENSER, Smithsonian Institution, *Washington, District of Columbia* 20560

This will be one of a series of monographs on the history and restoration of aircraft in the NASM Collection.

The manuscript is complete and it will be submitted for publication in December 1977.

SUPPORTED BY Smithsonian Institution, National Air & Space Museum

11.0004, A PRECOOPERATIVE EDUCATION PROGRAM
D.M. ETTER, Univ. of New Mexico, School of Engineering, *Albuquerque, New Mexico* 87106 (NGT 32-004-770)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

11.0005, TECHNOLOGY TRANSFER STUDY
I.R. FELLER, Penn. State University, School of Earth & Min. Sci., *University Park, Pennsylvania* 16802 (NAS 5-24329)

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VOLUME 16 NUMBER 5 / MARCH 8, 1978

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

No abstracts in this category.

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N78-13998*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

AERODYNAMIC CHARACTERISTICS OF A SMALL-SCALE STRAIGHT AND SWEPT-BACK WING WITH KNEE-BLOWN JET FLAPS

Gilbert G. Morehouse, William T. Eckert, and Robert A. Boles (Lockheed-Georgia Co., Marietta) Oct. 1977 125 p refs

(NASA-TM-78427; A-7161) Avail: NTIS HC A06/MF A01 CSCL 01A

Two sting-mounted, 50.8 cm (20 in.) span, knee-blown, jet-flap models were tested in a large (2.1- by 2.5-m (7- by 10-ft) subsonic wind tunnel. A straight- and swept-wing model were tested with fixed flap deflection with various combinations of full-span leading-edge slats. The swept-wing model was also tested with wing tip extensions. Data were taken at angles-of-attack between 0 deg and 40 deg, at dynamic pressures between 143.6 N/sq m (3 lb/sq ft) and 239.4 N/sq m (5 lb/sq ft), and at Reynolds numbers (based on wing chord) ranging from 100,000 to 132,000. Jet flap momentum blowing coefficients up to 10 were used. Lift, drag, and pitching-moment coefficients, and exit flow profiles for the flap blowing are presented in graphical form without analysis. Author

N78-13999# General Dynamics/Convair, San Diego, Calif.

CALCULATIONS OF SOME UNSTEADY TRANSONIC FLOWS ABOUT THE NACA 64A006 AND 64A010 AIRFOILS Final Report, Nov. 1975 - Apr. 1977

R. J. Magnus Jul. 1977 98 p refs

(Contract F33615-76-C-3018)

(AD-A046178; AFFDL-TR-77-46) Avail: NTIS HC A05/MF A01 CSCL 01/3

Unsteady transonic flows over airfoils were calculated using a program based on the unsteady Euler equations. The approximate numerical solutions were obtained using an explicit (Lax-Wendroff) difference scheme. Calculations were made for the 64A006 airfoil at zero angle-of-attack in flows with Mach number 0.822, 0.854 and 0.875. Three unsteady flows caused by a quarter-chord flap oscillating with an amplitude on the order of one degree at specific reduced frequencies (k = omega C/U sub infinity) near 0.4 were analyzed. The results were compared with other available calculations and the experimental data of Tijdeman. Responses for an airfoil in a ventilated-wall wind tunnel rather than in a free-stream were also calculated. Exploratory study of the changes to be expected with a weakened shock (an attempt to simulate a main effect of the interaction of the shock with airfoil boundary layer) was done for one case at Mach number 0.875. Oscillatory flows over the 64A010 airfoil at zero angle-of-attack in a Mach 0.80 stream were also calculated. Plunging motion at reduced frequency 0.4 and pitching motions at reduced frequencies 0.4 and 0.5 were calculated.

Author (GRA)

N78-14000# Vought Corp., Dallas, Tex.

INVESTIGATION OF A VARIABLE CAMBER WING DESIGN Final Report, Jul. 1976 - May 1977

T. D. Beatty, W. B. Brooks, and L. D. Robinson May 1977 189 p refs

(Contract N62269-76-C-0361)

(AD-A045951; NADC-76114-30; Rept-2-53300/7R-5977) Avail: NTIS HC A09/MF A01 CSCL 20/4

The principal objective of this NASC sponsored investigation involved definition of the buffet free transonic maneuvering benefits derivable from an innovative skewed hingeline variable camber wing design concept. These benefits have been established from comparisons of the predicted performance obtainable with this camber concept with those of conventional uncambered and fixed camber wing designs in a common aircraft application. The aircraft configuration considered in these performance comparisons was selected as representative of an advanced lightweight fighter aircraft. Wing aerodynamic characteristics for the differing aircraft configurations were established from analysis of experimental data available from prior test programs. Analytical methods were utilized to aid in the analysis required to evaluate the influence of Reynolds number and test installation interference effects upon the experimental results. For the aircraft configuration of this study program, it was found that substantial improvements to buffet-free performance could be attained from implementation of this camber concept. For subsonic flight conditions the maximum buffet free performance was attained with a camber scheduling which also yielded minimum drag. At transonic conditions, however, greatest improvements in buffet free performance was achieved only with wing camber configurations producing aircraft drag levels above the minimum. GRA

N78-14001# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.

A NUMERICAL STUDY OF VISCOUS FLOWS AROUND AIRFOILS Interim Report

J. C. Wu, S. Sampath, and L. N. Sankar Sep. 1977 21 p refs Presented at AGARD Fluid Dyn. Panel Symp. on Unsteady Aerodyn., 26-28 Sep. 1977, Ottawa, Canada

(Contract N00014-75-C-0249; NE Proj. 061-226)

(AD-A046084) Avail: NTIS HC A02/MF A01 CSCL 20/4

The application of an integro-differential approach in the numerical study of unsteady viscous flows about airfoils is described. Two different procedures are presented. A procedure based on a stream function-vorticity formulation and on a

transformation technique is used in a study of a flow about an impulsively started 9% thick Joukowski airfoil at an angle of attack of 15 deg and a Reynolds number of 1000. Numerical results are presented and compared with available finite-difference results. A second procedure based on a velocity-vorticity formulation and on a hybrid finite difference-finite element technique is used in a study of a flow about an oscillating 12% thick Joukowski airfoil at a Reynolds number of 1000. With either procedure, the unique ability of the integro-differential approach to confine the solution field to the vortical region of the flow is utilized. It is shown that this ability offers great computational advantages. Author (GRA)

N78-14002# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Hauptabt. Flugbetrieb.

SUPPORTING INVESTIGATIONS DURING TESTING OF THE WDL-1 AIRSHIP IN GHANA AND UPPER VOLTA [BERICHT UEBER BEGLEITENDE UNTERSUCHUNGEN BEI DER ERPROBUNG DES LUFTSCHIFFES WDL-1 IN GHANA UND OBERVOLTA]

A. Lickleder 1976 45 p refs In GERMAN

(DLR-IB-536-76/3) Avail: NTIS HC A03/MF A01

Test flights were made in July and August 1976 in Ghana and the Upper Volta with an airship (blimp) with a view to using this means of transportation in countries not having sufficiently developed infrastructure. A day-to-day report is given of the flight, and measurements concerning hull temperature, filling gas (He) temperature, and atmospheric and biological effects on hull and control surfaces are reported. Operational problems are also dealt with. ESA

N78-14003# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Hauptabt. Flugbetrieb.

CALCULATION OF HORIZONTAL TAIL LOADS IN MANEUVERING FLIGHT

Jean Skudridakis Dec. 1976 129 p refs In GERMAN; ENGLISH summary

(DLR-IB-536-76/4) Avail: NTIS HC A07/MF A01

Horizontal tail loads in maneuvering flight conditions as a result of different kinds of stabilizer inputs, were calculated. To achieve a reasonable approach to the problem the complete longitudinal set of equations of motion were simplified with respect to the degrees of freedom of the system which were significantly reduced from 6 to 3 or 2 degrees. With these simplifications a solution of equations of motions was obtained by analog computer, numerical integration, or by Laplace transforms. A detailed set of elevator input time histories and referring equations is presented. The application of these sets may help to establish conditions which are as close as possible to reality for the calculation of horizontal tail loads with respect to different airworthiness standards and design instructions. The influence of elasticity of the airplane structure is discussed briefly. Author (ESA)

N78-14004# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik det Atmosphaere.

ATMOSPHERIC ENVIRONMENTAL CONDITIONS DURING TESTING OF THE WDL 1 AIRSHIP IN GHANA AND UPPER VOLTA [BERICHT UEBER BEGLEITENDE UNTERSUCHUNGEN BEI DER ERPROBUNG DES LUFTSCHIFFES WDL 1 IN GAANA UND OBERVOLTA. ATMOSPHAERISCHE UMGEBUNGSBEDINGUNGEN]

R. Roth 23 Mar. 1977 81 p refs In GERMAN

(DLR-IB-553-77/4) Avail: NTIS HC A05/MF A01

Test flights were made in July and August 1976 in Ghana and the Upper Volta with an airship (blimp) with a view to using this means of transportation in countries not having sufficiently developed infrastructure. Surveys of the atmospheric conditions averaged over the year are presented. Conditions were generally found acceptable for flights; however, a problem concerning loading operations still needs to be resolved. ESA

N78-14005# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).

INVESTIGATION OF THE STRUCTURE OF THE WAKE BEHIND A CIRCULAR CYLINDER WITH OR WITHOUT END PLATES BY MEASURING NATURAL TEMPERATURE OSCILLATIONS [UNTERSUCHUNG DER STRUKTUR EINES NACHLAUFES HINTER EINEM KREISZYLINDER MIT UND OHNE ENDSCHEIBEN MITTELS MESSUNG DER NATUERLICHEN TEMPERATURSCHWANKUNGEN]

F. Albers, D. W. Schmidt, and W. J. Wagner Apr. 1977 55 p refs In GERMAN

(MPIS-25/1976) Avail: NTIS HC A04/MF A01; Max-Planck-Inst. fuer Stroemungsforsch., Goettingen, West Ger. DM 18.45

The possibility of reducing the three-dimensional disturbances in the wake behind a circular cylinder by applying end plates was investigated. The end plates produce a wake downstream, but in the near field no influence of the end plate wake was noticeable. It was found that the application of end plates produces a more regular and orderly separation of the total vortex behind the cylinder, that is, the distances of neighbor vortex nuclei near the cylinder show relatively low oscillations than is the case when no end plates are used. The end plates, however, do not provoke an ideal two-dimensional wake: the average elongation of the vortex in the direction of the cylinder is smaller than the distance between the end plates. ESA

N78-14006# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).

BOUNDARY LAYER EFFECTS AT TRANSONIC FLOW AROUND A SYMMETRICAL PROFILE [GRENZSCHICHTEFFEKTE BEI DER TRANSSONISCHEN UMSTROEMUNG EINES SYMMETRISCHEN PROFILS]

W. J. Hiller and G. E. A. Meier Mar. 1977 17 p refs In GERMAN

(MPIS-9/1977) Avail: NTIS HC A02/MF A01; Max-Planck-Inst. fuer Stroemungsforsch., Goettingen, West Ger. DM 6.05

The influence of the boundary layer on the transonic flow around the symmetrical profiles 0.10-0.675-1.6 and 0.11-0.75-1.25 was studied. The profiles are larger than those used in earlier studies, hence the Reynolds numbers are larger. Increased boundary layer disturbances, i.e. deviations from the ideal flow were found, caused by the increased displacement of the boundary layer at the side walls of the channel, by the laminar separation of the boundary layer in the region of the first pressure increase at the profile shoulder, and by the condensation boundary layer. Possibilities to reduce these disturbances are indicated. ESA

N78-14007# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abt. Theoretische Aerodynamik.

A TWO-DIMENSIONAL METHOD FOR CALCULATING UNSTEADY PRESSURE DISTRIBUTIONS ON RAILROAD TRAINS [EIN ZWEIDIMENSIONALES VERFAHREN ZUR BERECHNUNG INSTATIONAERER DRUCKVERTEILUNGEN AN EISENBAHNZUEGEN]

J. Steinheuer May 1977 92 p refs In GERMAN

(DLR-IB-151-77/8) Avail: NTIS HC A05/MF A01

A method is discussed for calculating unsteady aerodynamic phenomena occurring upon the encounter of high speed railroad trains and on their entering a tunnel; it is based upon two-dimensional potential flow. A singularity method is used for calculation of the potential as a function of time and the contour velocity, incorporating source distributions on body contours (trains, tunnel walls). Tail contours are open to approximate effects of wake flow. The coefficient of the unsteady static pressure is formed by accounting for the potential variation in time. Longitudinal and lateral forces, as well as the moment, result from the integration of the pressure distribution. A FORTRAN program is described. ESA

N78-14008# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abt. Theoretische Aerodynamik.

THE THICKNESS DISTRIBUTION OF PROFILES FOR SHOCK-FREE FLOW WITHOUT LIFT [UNTERSUCHUNGEN UEBER DIE DICKENVERTEILUNG VON PROFILEN BEI STOSSFREIER UMSTROEMUNG OHNE AUFTRIEB]

H. Hansen Jun. 1977 26 p refs In GERMAN Prepared jointly with MBB, Hamburg

(DLR-IB-151-77/9) Avail: NTIS HC A03/MF A01

The maximum obtainable airfoil profile thickness for the

simplest supercritical roof-top pressure distributions was determined using systematic exemplary calculations with the profile design method based on the integral method. These thick profiles with shock-free supercritical flow are especially suitable for application to transport aircraft. The maximum thickness limits found are in good agreement with empirical estimations. ESA

N78-14009# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.

SOME MEASUREMENTS IN THE WAKE BEHIND A CIRCULAR CYLINDER

D. M. Passchier Mar. 1977 53 p refs

(VTH-LR-229) Avail: NTIS HC A04/MF A01

Measurements are reported in the wake behind a 2 mm diameter circular cylinder at a free stream velocity of 50 m/sec. Mean velocities, longitudinal turbulence intensity, and turbulent shear stresses were measured by means of linearized hot wire equipment, up to 1000 cylinder diameters downstream. Mean velocity profiles are shown to collapse into a universal curve for x greater than or equal to 100 d. Turbulence data also show a universal distribution for x greater than or equal fo 100 d. A correction procedure is given for linearized hot wire calibration drift during measurements. Author (ESA)

N78-14010# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.

A CALCULATION METHOD FOR THE INCOMPRESSIBLE TWO-DIMENSIONAL TURBULENT WAKE WITH STREAMWISE PRESSURE GRADIENT

D. M. Passchier May 1977 76 p refs

(VTH-LR-230) Avail: NTIS HC A05/MF A01

A method for calculating incompressible two-dimensional turbulent wakes with arbitrary longitudinal pressure gradient is given. Basic assumptions are: similarity of the velocity defect profile when scaled with the maximum defect and the half width to half depth, and similarity of the turbulence properties. The equations used are integrated forms of the momentum equation and the turbulent energy equation, together with an entrainment equation. The entrainment velocity is shown to be proportional to the square of the turbulent velocity scale divided by the mean velocity scale. The integrated similarity profiles of mean velocity and turbulence properties give rise to a number of universal constants, most of which are determined from experiments, two by trial and error. The calculation method is compared with a number of experiments. The results agree quite well in general. Convergence corrections for collateral flow are given, and the use of other auxiliary equations instead of the entrainment equation is considered. Author (ESA)

N78-14011# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.

DESCRIPTION OF A FIVE-PARAMETER PROFILE FAMILY [BESCHRIJVING VAN EEN VIJFPARAMETER PROFIELFAMILIE]

J. J. H. Blom May 1976 115 p refs In DUTCH

(VTH-LR-220) Avail: NTIS HC A06/MF A01

The five-parameter mapping method of Geckeler-Mueller, for airfoil profiles, is discussed. This method is based on a von Karman-Trefftz transformation of an ellipse and is simpler to handle than the von Mises method. Joukowsky, von Karman-Trefftz but also S-shaped, von Mises-like profiles can be obtained depending on the choice of the available parameters. These three profile families are examined. The conditions the mapping function needs to satisfy as well as the requirement for steady profile behavior are discussed. The two profile families designed by Mueller are analyzed. ESA

N78-14012# Bristol Univ. (England). Dept. of Aeronautical Engineering.

THE AERODYNAMIC PERFORMANCE OF A FREELY-HINGED DOOR WITH A BLUNT TRAILING EDGE BETWEEN TWO STREAMS B.S. Thesis

S. A. Bizon and S. A. Taylor Jun. 1977 81 p refs

(BU-206) Avail: NTIS HC A05/MF A01

An experimental study of the performance of a freely-hinged door positioned in a wall separating two incompressible flows of different total pressures and velocities is presented. The angle to which the door opens and the mass flow passing through the door were measured and are presented as functions of a velocity ratio (Rsubv) and a suitable pressure difference coefficient (Csubp). The general behavior of these quantities is explained and a comparison is made with results obtained for a larger door, no door, and simple theoretical analyses. The trends discovered were that both the door angle and the mass flow through the door increased with an increase in Csubp, whereas for an increase in Rsubv the door angle decreased and the mass flow increased. The effect of a stagnation point formed on the edge of the separating wall at the door trailing edge was found to be an important influence on the characteristics of the flow. These investigations are a sequel to those on the performance of a door with a tapered trailing edge under the same experimental conditions. Author (ESA)

N78-14013# Bristol Univ. (England). Dept. of Aeronautical Engineering.

AN INVESTIGATION INTO THE AERODYNAMIC CHARACTERISTICS OF AXISYMMETRIC BLUFF BODIES OF ELLIPSOIDAL SHAPE WITH PROTUBERANCES B.S. Thesis

A. Postlethwaite and D. L. Warner Apr. 1977 80 p refs

(BU-209) Avail: NTIS HC A05/MF A01

The aim of the series of experiments was to gain an understanding of the flow around bluff, axisymmetric bodies with a protuberance. The experiments included a series of tests for comparison with results already obtained by Westland Helicopters for the 'Wisp'. Also, tests were carried out on various similar configurations. Along with measurement of pressure distributions and forces, flow visualization techniques were employed. It was found that attachment of the protuberance (rotor shaft) to the upper surface modified the force coefficients, frequently in an unexpected manner, and its presence dominated the upper surface flow. It has been concluded that all shapes subject to the axisymmetric constraint are likely to be inherently unstable, but future work, in the form of a full pressure tapping or boundary layer suction experiments, could minimize the problems.

Author (ESA)

N78-14014# Bristol Univ. (England). Dept. of Aeronautical Engineering.

INVESTIGATION INTO THE EFFECT OF ANGLE OF YAW ON THE PRESSURE MEASUREMENTS MADE BY A SQUARE CYLINDRICAL PITOT TUBE B.S. Thesis

S. H. Goudie Jun. 1977 45 p refs

(BU-210) Avail: NTIS HC A03/MF A01

A cylindrical pitot tube has been found to measure a constant pitot pressure for yaw angle up to some critical angle. This angle was found to increase with ratio of internal to external diameters. The theory that a pitot tube no longer measured the ideal pitot pressure above the critical angle of yaw due to the stagnation streamline falling outside the pitot tube opening was given support by the measurements of pressures on the face of the pitot tube and also by the movement of the stagnation point across a cylinder face. Smoke and water flow visualization methods agree with the hot-wire anemometer results showing the presence of a dividing streamline between internal and external flows of the pitot tube. They also show that this dividing streamline became unsteadier with increased angle of yaw above the critical angle. The Reynolds number for all the pressure measurement tests was 100,000. For hot-wire anemometer tests this Reynolds number, based on the pitot tubes external diameter, was 80,000, and for smoke flow visualization was rather less. Author (ESA)

N78-14015# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Aeroelastik.

NUMERICAL CALCULATION OF UNSTEADY AERODYNAMIC PRESSURE DISTRIBUTION ON HARMONICALLY OSCILLATING WINGS IN SUBSONIC FLOW. THEORY AND RESULTS FOR COMPRESSIBLE FLOW, PART 2

Wolfgang Geissler 22 Apr. 1977 52 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-430)

(DLR-FB-77-15) Avail: NTIS HC A04/MF A01; DFVLR, Cologne DM 25,90

A numerical method to calculate the unsteady pressure and force distributions on harmonically oscillating three-dimensional

wings with control surfaces in subsonic flow is presented. This panel-method is based on the velocity potential and has the advantage that local unsteady lift and moment coefficients necessary for flutter investigations can be determined in a simple and sufficient way. The numerical method for compressible flow is described in detail and numerous results and comparisons with other methods and with experimental data are presented.
Author (ESA)

N78-14188# European Space Agency, Paris (France).
MEAN NUMBER OF LOADS AND ACCELERATIONS IN ROLL OF AN AIRCRAFT FLYING IN TURBULENCE
Gabriel Coupry *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1976-6 (ESA-TT-406) Oct. 1977 p 58-69 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-6, Nov.-Dec. 1976 p 333-338 Original report in FRENCH previously announced as A76-43142 (For availability see N78-14184 05-31)
Avail: NTIS HC A06/MF A01

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N78-14016*# Stanford Univ., Calif. Dept. of Civil Engineering.
ASSESSING THE FUTURE OF AIR FREIGHT Final Technical Report, Feb. - Oct. 1977
Jarir S. Dajani Nov. 1977 34 p refs
(Grant NsG-2203)
(NASA-CR-155356) Avail: NTIS HC A03/MF A01 CSCL 01C

The role of air cargo in the current transportation system in the United States is explored. Methods for assessing the future role of this mode of transportation include the use of continuous-time recursive systems modeling for the simulation of different components of the air freight system, as well as for the development of alternative future scenarios which may result from different policy actions. A basic conceptual framework for conducting such a dynamic simulation is presented within the context of the air freight industry. Some research needs are identified and recommended for further research. The benefits, limitations, pitfalls, and problems usually associated with large scale systems models are examined. Author

N78-14017# Payne, Inc., Annapolis, Md.
DEVELOPMENT OF AN ULTRA HIGH LEVEL AIRDROP CONTAINER CONCEPT Final Report, Jun. 1974 - May 1977
Peter R. Payne Sep. 1977 24 p
(Contract DAAK03-74-C-0197)
(AD-A046156; Working-Paper-138-11) Avail: NTIS HC A02/MF A01 CSCL 13/4

A study was undertaken to determine the form and aerodynamic characteristics of an airdrop container capable of achieving a specified accuracy when dropped from ultra-high levels. This study resulted in a final design for a semi-streamline aeroshell which was shown to meet the limited technical criteria on which the program was based. During the program, half-scale models were dropped from helicopters at Natick, and wind-tunnel tested in the University of Maryland Glenn L. Martin Wind Tunnel. A six-degree-of freedom trajectory program was assembled and proven. It is now available for a statistical analysis of delivery accuracy. Author (GRA)

N78-14018# Naval Air Development Center, Warminster, Pa. Dept. of Crew Systems.
EJECTION UNDER DECELERATION
Russell L. Sanford and Kenneth L. Miller 16 Aug. 1977 35 p refs
(WF1451402)
(AD-A046117; NADC-77209-40) Avail: NTIS HC A03/MF A01 CSCL 01/3

The objective of this test program was to investigate the phenomenon of decelerative forces on the ESCAPAC 1A-1 ejection seat installed in the U.S. Navy A-4A, B, C and E series attack aircraft. This phenomenon may be encountered, for example, during actual ejection attempts coincident with loss of control on take-off coupled with heavy breaking, skidding and/or failure of the nosegear or one main landing gear. Decelerative forces may also be present during arrested landings on carriers as well as emergency arrestments on hard-surfaced runways. It is concluded that serious attention should be given to revising the technique presently incorporated in the ESCAPAC 1A-1 ejection seat for effecting seat/man separation. Particular emphasis should be placed upon possible relocation of the SNUBBER line attachment points of the ejection seat which, it is felt, contributed to the unsatisfactory seat/man separation characteristics demonstrated in this program. The reason for the repeated failure of the SNUBBER weak links to function properly should also be determined. Additionally, consideration should be given to replacing the present DART/SNUBBER stabilization-seat/man separation subsystem with a current state-of-the-art subsystem that relies neither upon physical connections to the aircraft nor time lapse, dynamic displacement, corrective momentum inputs to achieve seat stabilization. GRA

N78-14019# Battelle Pacific Northwest Labs., Richland, Wash.
ASSESSMENT OF THE RISK OF TRANSPORTING PLUTONIUM DIOXIDE BY CARGO AIRCRAFT
T. I. McSweeney and J. F. Johnson Jun. 1977 165 p refs
(Contract EY-76-C-06-1830)
(BNWL-2030) Avail: NTIS HC A08/MF A01

The characteristics of the nuclear economy used in this analysis are: A total of 18 metric tons (MT) of plutonium is shipped annually, via the mode being evaluated. 100 kg of plutonium are transported per shipment. The average shipping distance per shipment is 1,422 miles with 14 percent of the distance being by truck. Plutonium dioxide was assumed to be carried exclusively in the 15-gal version of the 6M container. Based on the shipping assumptions, the likelihood that an aircraft carrying a shipment will be involved in an accident is estimated to be about once in 450 years. For the projected shipping rate in the early 1980s, the likelihood of a release of plutonium as a result of shipment by air is one in 900 years for dioxide powder in the 6M container. The comparison of the truck and air transport modes for the same material showed truck transport to have less risk. At the same time, the air transport of plutonium dioxide was demonstrated to have a lower risk than other commonly accepted societal risks. ERA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N78-14020# Royal Aircraft Establishment, Farnborough (England).
STATISTICAL AND FLIGHT DYNAMIC STUDIES ON CONFLICT DETECTION AND RESOLUTION IN CIVIL AVIATION
Otto Weber May 1977 115 p refs Transl. into ENGLISH of "Statistische und Flugmechanische Untersuchungen zur Visuellen Konfliktentdeckung und -Loesung im Luftverkehr", Rept. DLR-FB-75-71 DFVLR, West Ger., 1975
(RAE-Lib-Trans-1903; BR59443; DLR-FB-75-71) Avail: NTIS HC A06/MF A01

Conflict detection and resolution by the see and avoid concept are considered. American and German statistics on mid-air and near mid-air collisions are discussed. For flights without acceleration, basic geometrical and physical aspects of conflict detection

are derived and details given on the angles of vision from the pilot to the other aircraft and on blind spots. Horizontal evasive maneuvers are analyzed in detail and their effectiveness is presented in many graphs. Two observation error models are described and their influences on the distances are estimated where horizontal evasive maneuvers are possible. Vertical maneuvers are treated concisely and some tentative suggestions to the improvement of flight safety are made. Author

N78-14021*# Cutler-Hammer, Inc., Farmingdale, N.Y. AIL Div.
MICROWAVE SCANNING BEAM LANDING SYSTEM, GROUND STATION: PERFORMANCE TEST REPORT. VOLUME 1: EXECUTIVE SUMMARY
20 Aug. 1977 17 p
(Contract NAS9-14543)
(NASA-CR-151582; JSC-11525-Vol-1) Avail: NTIS HC A02/MF A01 CSCL 17G

Conclusions and recommendations are presented based on data evaluation as developed to date and detailed in Engineering Test Summary Reports. Author

N78-14022# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DABS COVERAGE
S. I. Krich 16 Aug. 1977 89 p refs
(Contracts DOT-FA72WAI-261; F19628-76-C-0002)
(AD-A045940; ATC-75; FAA-RD-77-77) Avail: NTIS HC A05/MF A01 CSCL 01/2

The DABS coverage within CONUS was projected on a statistical or percent coverage basis by purely geometrical considerations. Results are given for CONUS, the eastern half of the U. S., and for the Golden Triangle. Profile coverage (line-of-sight coverage down to....) is given for the Boston-NYC-Washington corridor. Author

N78-14023# Federal Aviation Administration, Washington, D. C. Office of Systems Engineering Management.
A PRELIMINARY EVALUATION OF THE ATCRBS SIGNAL FORMAT FOR THE BCAS DATA LINK
E. J. Koenke, P. M. Ebert, W. H. Harman, N. A. Spencer, and A. Weinberg Aug. 1977 40 p
(AD-A046164; FAA-EM-77-9; W46-0273) Avail: NTIS HC A03/MF A01 CSCL 01/2

The integrity of the ATCRBS signal format for the BCAS data link was evaluated based on measurements of the actual RF environment today, simulations of sophisticated signal processors, and basic calculations. The conclusions reached by the task force all relate to achieving a high integrity data link tailored to the BCAS application and were derived from tests run on the DABS ground-based reply processor-they are the following: Results show that: (1) a data link with a high degree of error protection coding is essential; (2) multiple transmissions are essential; and (3) a two-way data link is highly desirable from the point of view of the coordination logic. Author

N78-14024*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
NAVIGATION FOR IUS DEPLOYMENT. TDRSS NAVIGATION ACCURACY IN SUPPORT OF IUS DEPLOYMENT, PHASE 1
Alan D. Wylie Oct. 1977 36 p refs
(NASA-TM-74955; JSC-13125) Avail: NTIS HC A03/MF A01 CSCL 17G

The navigation accuracy for tracking the orbiter prior to interim upper stage (IUS) deployment using the tracking dara relay satellite system (TDRSS) was studied. The orbiter navigation accuracy for both one and two TDRSS satellites, for short and long data arcs, and for Doppler-only and Doppler-plus range solutions was examined. All test cases were run with the orbiter in a 150-n. mi. circular orbit, 28.5 degree inclination, at the time interval from the completion of the orbital maneuvering system (OMS)-2 maneuver to OMS-2 plus 2 hours (approximate time for IUS deployment). The data used were simulated by the simulation navigation (SIMNAV) program. The software tool used to process the TDRS data was the Shuttle Navigation Analysis Program (SNAP), a Kalman filter tool used to solve for the orbiter position and velocity. Results summarize the expected navigation accuracy using the TDRS system. It was concluded that: (1) data from both TDRS satellites were essential for accurate navigation results: (2) range data were essential for the short arc test case but were not needed for the long arc test case; and (3) with Doppler and range data from both TDRS satellites, the results converged to a reasonable solution after 5 to 10 minutes of data. Author

N78-14025# IIT Research Inst., Annapolis, Md.
COMPUTER SIMULATIONS OF ATCRBS PROCESSING EQUIPMENT FOR USE WITH THE AIMS AND TRANSIENT EFFECTS PERFORMANCE PREDICTION MODELS Final Report
C. Randall Crawford Jan. 1976 48 p refs
(Contract DOT-FA70WAI-175; F-19628-76-C-0017; AF Proj. 649E)
(AD-A046758; ECAC-PR-75-062; FAA-RD-76-102) Avail: NTIS HC A03/MF A01 CSCL 17/7

The transient effects PPM is a pulse-by-pulse simulation of ATCRBS operation, which was developed to assist in the investigation of the short-term, or transient phenomena of ATCRBS performance. The pulse-by-pulse correlation technique of the defruiter, the functions of the analog decoder, and the target-detection and code validation functions of the digital processor have been incorporated into these models. The models which were developed for the AIMS PPM provide predictions of equipment performance in terms of probabilities of target detection and code validation. Author

N78-14026# Transportation Systems Center, Cambridge, Mass.
AIR TRAFFIC CONTROL EXPERIMENTATION AND EVALUATION WITH THE NASA ATS-6 SATELLITE. VOLUME 1: EXECUTIVE SUMMARY Final Report, Sep. 1973 - Dec. 1975
Sejfi Protopapa Aug. 1977 43 p
(Contract DOT-TSC-707-1)
(AD-A046509; D6-44052-Vol-1; FAA-RD-75-173-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 17/7

The ATS 6 satellite was used in tests designed to collect satellite-aircraft signal propagation data, evaluate L-band avionics hardware designs, and perform preliminary satellite voice and data communications demonstration tests in support of the AEROSAT program which proposes to eliminate communication gaps between aircraft enroute in oceanic airspace and continental air traffic control facilities. Technology tests described include: multipath channel characterization (oceanic and overland); modem tests of voice, data and ranging; and aircraft antenna tests. Voice modem intelligibility scores, digital data bit error rates and ranging modem performance are presented parametrically as functions of C/N and S/I. Experimentally derived gain and multipath rejection performance data are given for the slot-dipole, phased-array and patch antennas for various aircraft/satellite geometries. Author

N78-14027# National Aviation Facilities Experimental Center, Atlantic City, N. J.
EVALUATION OF THOMSON/CSF FIVE-BAY VOR ANTENNA Final Report, Jan. - Nov. 1976
James G. Dong Oct. 1977 77 p refs
(AD-A046756; FAA-NA-77-7; FAA-RD-77-82) Avail: NTIS HC A05/MF A01 CSCL 17/7

A stacked five-bay VOR antenna designed for use with a conventional very high frequency omnidirectional radio range (VOR) system to reduce multipath effects by diminishing ground reflections was evaluated. Tests included airborne and ground measurements to assure operational compatibility of the antenna with FAA transmitting equipment. Measurements were made on the complete array, bays, and antenna elements. Test results indicate that the bearing error was marginal and the large sidelobes caused multipath reflection from nearby obstacles. A computer program used for the analysis of vertical plane radiation patterns in stacked arrays is included. Author

N78-14028# National Aviation Facilities Experimental Center, Atlantic City, N. J.
BEACON COLLISION AVOIDANCE SYSTEM (BCAS); ACTIVE MODE Interim Report, Mar. 1975 - Jul. 1976
Maurice Cohen and Charles Richardson Oct. 1977 35 p
(AD-A046757; FAA-NA-77-11; FAA-RD-77-98) Avail: NTIS HC A03/MF A01 CSCL 17/7

The active mode of the beacon collision avoidance system (BCAS) through its initial phase is described as well as the hardware and theory of operation. The system performance and accuracy during feasibility flight tests are discussed. This is a ground-independent, air-to-air system activated by airborne omnidirectional ATCRBS mode C interrogations occurring at a rate of 2 per second. Range and altitude are obtained for each aircraft replying within a 32-nmi radius. Range and altitude rates are computed, and approaching aircraft are tracked. The cockpit CAS display warns the pilot of aircraft crossing with adequate altitude separation and gives a command to climb or dive if the intruding aircraft is at or near the same altitude. Warnings and/or commands are provided 30 seconds before range minimum. System performance was evaluated during test encounters with 400 ft altitude separation. Performance and accuracy analysis was derived from BCAS and ARTS III magnetic tape, and from the tracking phototheodolites over the measurement range.
Author

N78-14029# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DEVELOPMENT OF A DISCRETE ADDRESS BEACON SYSTEM Quarterly Technical Summary, 1 Apr. - 30 Jun. 1977
1 Jul. 1977 13 p
(Contracts DOT-FA72WAI-261; F19628-76-C-0002; FAA Proj. 034-241-012)
(AD-A046580; FAA-RD-77-107) Avail: NTIS HC A02/MF A01 CSCL 17/7

Topics covered include: restructuring the DABS national standard; the prototype sensor back-to-back antenna; ARIES diagnostic software, and all hardware; site characteristic measurements and DABS netting experiments. A.R.H.

N78-14030# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
DESIGN, DEVELOPMENT, ANALYSIS, AND LABORATORY TEST RESULTS OF A KALMAN FILTER SYSTEM-LEVEL IMU CALIBRATION TECHNIQUE Final Report, Jul. 1973 - Nov. 1975
Richard A. Kitzerow Jun. 1977 253 p refs
(AD-A046257; AFAL-TR-77-75) Avail: NTIS HC A12/MF A01 CSCL 17/7

The United States Air Force Avionics Laboratory at Wright-Patterson Air Force Base, Ohio, is presently conducting inhouse advanced aided-inertial navigation software development programs. This report describes the design, development, analysis, and laboratory test results of an IMU calibration and error model development methodology formulated to support the design and test of inertial navigation software and associated Kalman filters. The IMU error analysis methodology incorporates a 68-state Kalman filter and uses only system-level IMU velocity and gimbal angle measurements taken during a two and a half hour, twelve-platform attitude test to estimate IMU significant error sources relative to the inertial instrument random disturbances. The Kalman filter incorporates a number of error model residual states which provide a measure of the degree to which the test article conforms to the assumed IMU error model. IMU error parameter estimation can be accomplished either on-line in real time or off-line using recorded IMU measurements. Results obtained from both a CDC-6600 computer simulation of the IMU calibration problem and a laboratory development program indicate that the technique is conceptually more comprehensive and accurate, and requires less specialized test equipment and test time than conventional calibration methods. The technique appears to be a likely candidate for IMU acceptance and intermediate and depot level maintenance tests. Author (GRA)

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N78-14031*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
WIND-TUNNEL INVESTIGATION OF THE AERODYNAMIC PERFORMANCE, STEADY AND VIBRATORY LOADS, SURFACE TEMPERATURES AND ACOUSTIC CHARACTERISTICS OF A LARGE-SCALE TWIN-ENGINE UPPER-SURFACE BLOWN JET-FLAP CONFIGURATION
Nov. 1975 163 p refs
(NASA-TM-X-72794) Avail: NTIS HC A08/MF A01 CSCL 01C

Tests have been conducted in full-scale tunnel to determine the aerodynamic performance, steady and vibratory aerodynamic loads, surface temperatures, and acoustic characteristics of a large scale, twin turbofan engine, upper surface blown jet-flap configuration. The tests were made for an angle of attack range from -6 deg to 28 deg and a thrust coefficient range from 0 to 4 for trailing edge flap deflections of 32 deg and 72 deg.
Author

N78-14032# Royal Aircraft Establishment, Farnborough (England).
ICING PROBLEMS ON HELICOPTER ROTORS
H. Bestek Jun. 1977 11 p Transl. into ENGLISH from DFVLR Nachrichten. (West Germany), Apr. 1972 p 236-238
(BR59303; RAE-Trans-1912) Avail: NTIS HC A02/MF A01

Water trapping at any particular point on a rotor blade is influenced by atmospheric conditions as well as by flow characteristics at the blade. The shape of the ice deposits is determined mainly by the equilibrium temperature at the blade surface. The effects of icing on the flying properties of helicopters is discussed, and the effectiveness of anti-icing and deicing systems are explored. The use of plastic coatings for blade surface treatment to reduce the adhesion of ice deposits is assessed.
A.R.H.

N78-14033# Federal Aviation Administration, Moffett Field, Calif. Flight Simulation Branch.
CERTIFICATION STUDY OF A DERIVATIVE MODEL OF A SMALL JET TRANSPORT AIRPLANE USING A PILOTED RESEARCH SIMULATOR Final Report
Raymond D. Forrest Jun. 1977 86 p refs
(AD-A046442; FAA-RD-77-105) Avail: NTIS HC A05/MF A01 CSCL 01/3

The flight simulator for advanced aircraft at Ames Research Center was used to evaluate the flying qualities of a small jet transport and those of a derivative model of that airplane. Technical criteria that piloted simulations must meet to enable their increased use for demonstrating compliance with transport category aircraft airworthiness requirements were defined. Flying-qualities data were obtained for numerous test configurations and conditions using conventional certification flight test procedures. These data correlated well with the basic airplane data from the manufacturer's certification test report. Analysis of the simulator data show valid results in critical test cases, such as the demonstration of static longitudinal stability and minimum control speed, with confidence that all influencing and limiting factors were identified. An important aspect was the accurate simulation of the control force-feel qualities of the reversible flight control system. The simulator was judged to have duplicated actual flight results with a high degree of confidence. Author

N78-14034# Directorate of Aerospace Studies, Kirtland AFB, N. Mex.
FIRE: A DETERMINISTIC MODEL FOR ESTIMATING SURVIVABILITY THROUGH AREA SURFACE TO AIR MISSILE DEFENSES Final Report
Christopher A. Feuchter and Kenneth W. Smith Aug. 1977 69 p refs
(AD-A046119; DAS-TR-77-12) Avail: NTIS HC A04/MF A01 CSCL 15/3

One of the recurrent problems associated with the analysis of competing airborne system concepts in a wartime environment is the determination of comparable estimates of attrition from surface-to-air-missiles (SAMs). The FIRE attrition model is a partial solution to this need. It provides attrition estimates of single vehicles or groups of vehicles flying straight and level through a corridor containing up to 10 types of SAMs. The geometric and

temporal aspects of SAM/Penetrator interactions are modeled in substantial detail. This requires a fairly detailed SAM model. The penetrator on the other hand is characterized simply by speed, altitude, and a single salvo Pk relative to each SAM type. The model allows heuristic modelling of the effects of decoys, chaff, and electronic countermeasures (ECM) as penetrator aids. Author (GRA)

N78-14035# Boeing Commercial Airplane Co., Seattle, Wash.
DESIGN AND ANALYSIS OF WINGLETS FOR MILITARY AIRCRAFT, PHASE 2 Final Report, Jun. - Nov. 1976
K. K. Ishimitsu and D. F. Zanton May 1977 131 p refs
(Contract F33615-75-C-3123)
(AD-A046152; D6-45090; AFFDL-TR-77-23) Avail: NTIS HC A07/MF A01 CSCL 01/3

A study of the design and analysis of winglets for military aircraft has been completed. This study is a continuation of the work reported in AFFDL-TR-76-6. The program consisted of investigating analytically the AFFDL/Boeing winglet on the take-off and landing configuration of the KC-135A. Also investigated analytically were the effect of a wing leading-edge device on the performance of the AFFDL/Boeing winglet and the design of a compromise high-speed/low-speed winglet. Two wind tunnel tests were conducted by the NASA-Langley Research Center 8-foot transonic tunnel. A high-speed and low-speed test were conducted to determine the effect of the AFFDL/Boeing winglets on the KC-135A's aerodynamic performance and longitudinal and lateral-direction stability. A preliminary plan for a KC-135A winglet retrofit program was developed and its cost estimated. Based on a 1979 program start, the retrofit costs would be recovered by the start of 1984. GRA

N78-14036# Teledyne Ryan Aeronautical Co., San Diego, Calif.
MINI-RPV RECOVERY SYSTEM CONCEPTUAL STUDY Final Report
H. E. Dickard Aug. 1977 322 p refs
(Contract DAAJ-02-76-C-0048; DA Proj. 1F2-62209-AH-76)
(AD-A046177; TRA-29318-03; USAAMRDL-TR-77-24) Avail: NTIS HC A14/MF A01 CSCL 01/3

This study investigates and evaluates Mini-RPV recovery concepts potentially suitable for the U.S. Army tactical environment. The air vehicle on which the recovery study is based is the U.S. Army/Lockheed Aquila, XMQM-105 Mini-RPV at a nominal gross weight of 120 pounds. A hypothetical RPV counterpart at 200 pounds gross weight is also used to bound the upper weight limit for Mini-RPVs. GRA

N78-14037# Hughes Helicopters, Culver City, Calif.
FLIGHT TEST OF A COMPOSITE MULTI-TUBULAR SPAR MAIN ROTOR BLADE ON THE AH-1G HELICOPTER. VOLUME 1: MATERIALS, DESIGN AND TEST Final Report, Jun. 1974 - Jan. 1977
Robert E. Head Aug. 1977 327 p refs
(Contract DAAJ02-74-C-0055; AY968263)
(AD-A046176; HH-76-281-Vol-1;
USAAMRDL-TR-77-19A-Vol-1) Avail: NTIS HC A15/MF A01 CSCL 01/3

The objectives of this program were to design a composite main rotor blade in the multi-tubular spar configuration to be directly interchangeable (in pairs) with the production metal (540) blades on the AH-1G helicopter, have increased fatigue life, invulnerability to the 23mm ballistic threat, low radar cross section, and low fabrication cost. Manufacturing technology was developed and described in a Process Specification. Laboratory, ground, and flight tests demonstrated that the wet-filament wound, co-cured blade met, and in some cases surpassed, all objectives and could be adapted for Army service. Author (GRA)

N78-14038# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INCREASING THE SURVIVABILITY OF COMBAT AIRCRAFT
A. Tumanov 1 Feb. 1977 13 p Transl. into ENGLISH from Aviatsiya i Kosmonavtika (USSR), no. 4, Apr. 1968 p 51-53
(AD-A045910; FTD-ID(RS)I-0094-77) Avail: NTIS HC A02/MF A01 CSCL 01/3

It was only possible to armor aircraft after a new type of armor was created. This was a lighter form of armor which was considerably more bullet-resistant than that for tanks and ships. GRA

N78-14039# Lightning and Transients Research Inst., St. Paul, Minn.
INTEGRAL FUEL TANK SKIN MATERIAL HEATING FROM SWEPT SIMULATED LIGHTNING DISCHARGES Final Report
J. D. Robb and T. Chen Apr. 1977 45 p refs
(Contract N00421-76-C-0052)
(AD-A046074; L/T-636) Avail: NTIS HC A03/MF A01 CSCL 01/3

Studies have been carried out to determine the hot spot temperatures of swept laboratory lightning discharges using an infra red scanning camera, modified to provide higher time resolution with the LTRI St. Paul wind tunnel used to sweep the stroke. The data was compared with non swept (stationary arc) data. Somewhat higher energies were used in the test discharges corresponding to the new waveforms (SAE-Task F) including a 100,000 restrike and a 15 coulomb intermediate component superimposed on two hundred amperes of continuing current typical of natural lightning. The results indicate that with the thinner new materials, a hot spot ignition hazard definitely exists for the lower conductivity materials, titanium and stainless steel but less than had been previously estimated. Yet to be determined is the complete envelope of hot spot time duration versus temperature required for ignition. Author (GRA)

N78-14040# Army Scientific Advisory Panel, Washington, D. C.
REMOTELY PILOTED VEHICLES (RPVS) Final Report
30 Sep. 1977 45 p
(AD-A046087) Avail: NTIS HC A03/MF A01 CSCL 01/3

The Army's Remotely Piloted Vehicle (RPV) Program was reviewed. This review covered the AQUILA Program which was directed at the provision of a demonstrator vehicle for evaluation of the utility of an RPV for Reconnaissance, Target Acquisition, and Laser Designation (RSTAD). It also examines the adequacy of the available technology and ongoing development effort for implementing a daylight TV-laser-equipped mini-RPV suitable for operation in the battlefield environment. Finally, it looks into future potential uses by the Army of an RPV capability and the technology developments which will pace this use.Author (GRA)

N78-14041# National Swedish Road and Traffic Research Inst., Linkoeping.
ROLLING RESISTANCE OF AIRCRAFT WHEELS IN DRY SNOW
Bo Kihlgren 1977 36 p In SWEDISH; ENGLISH summary
(VTI-128) Avail: NTIS HC A03/MF A01

Measurements were carried out for the rolling resistance of an aircraft wheel caused by dry snow. The wheel was equipped with a tire of the dimension 12.50-16, which is used on aircrafts of types CV-440 and N-262. The measurements were carried out at a static wheel load of 38.800 N (3.960 kp) and a tire air pressure of 410 kPa (60 psi) and 550 kPa (80 psi), respectively. Speed during the measurements was 50 km/h. The rolling resistance seems to increase approximately proportionally to the increase of the snow depth at a constant tire air pressure. Increased tire air pressure causes a decrease of the rolling resistance. This effect indicates that tires with high air pressure should be used on aircraft wheels when taking off from snow-covered areas, even if the load on the wheels does not require a high tire air pressure. Measurements were also carried out for the rolling resistance of a tire of the dimension 7.50-14 caused by dry snow at different speeds. This tire is especially intended for friction measurements (ASTM tire). These measurements were performed at a static wheel load of 4.800 N (490 kp) and at speeds of 50, 65, and 80 km/h. The rolling resistance seems to increase proportionally to the increase of the speed within the interval of speed used. The influence of the speed on the rolling resistance seems to be greater in deep snow than in thin snow. Author (ESA)

N78-14042# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
LOW-SPEED WIND-TUNNEL TESTS OF THE LONGITUDINAL STABILITY CHARACTERISTICS OF SOME SWEPT-

WING QUIET AIRBUS CONFIGURATIONS
D. A. Kirby and A. G. Hepworth London Aeron. Res. Council 1977 93 p refs Supersedes RAE-TR-76029; ARC-36825 (ARC-R/M-3801; RAE-TR-76029; ARC-36825) Avail: NTIS HC A05/MF A01; HMSO £7; PHI $26.85

Measurements of lift, drag and pitching moment were made on model configurations representing rear-engined layouts, with large nacelles so positioned that both wing and tailplane will make a contribution to noise shielding. Only round nacelles were used with a high-wing model but both round and flat types of nacelle were tested on a low-wing model. The investigation concentrated on the effects of the large lifting surfaces of the nacelles on the longitudinal stability and performance under the high-lift conditions appropriate to take-off and landing; the nacelles were not powered so the influence of the jet efflux was excluded. The results show that the influence of the nacelles on the downwash at the tailplane is such as to offset the lift losses and longitudinal stability changes incurred by adding the nacelles to models without tailplane; so that for the complete models the stability changes were small, and the effects on performance only became appreciable when the flat nacelles were tilted several degrees nose down with a landing-flap setting. Included in the test program were measurements of the distribution of total head at a hypothetical engine face inside the round nacelles for a number of model configurations and conditions. Author (ESA)

N78-14043# Bristol Univ. (England). Dept. of Aeronautical Engineering.
CONSTRUCTION AND TESTING OF A CARBON FIBRE PRIMARY STRUCTURE FOR A MAN-POWERED AIRCRAFT WING B.S. Thesis
P. G. M. Heppel and E. C. Leaver Jun. 1977 67 p refs (BU-208) Avail: NTIS HC A04/MF A01

A box framework, typical of that found in the wing of a man-powered aircraft, was built using carbon fiber reinforced sandwich members. The structure was analyzed as a pin-jointed frame using the finite element method, and the results were compared with those obtained from a statically determinate solution. Aeroelastic problems such as wing divergence and aileron reversal were also studied. The framework was found to be 32% lighter than the equivalent one in spruce. When tested, the structure failed at a load which was 23% lower than anticipated. Suggestions are made for improving the strength of the structure. Author (ESA)

N78-14044# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abt. Flugmechanik der Flaechenflugzeuge.
DETERMINATION OF DYNAMIC CHARACTERISTICS FROM FLIGHT TEST DATA
Martin Marchand 20 Jun. 1977 23 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-434)
(DLR-FB-77-26) Avail: NTIS HC A02/MF A01; DFVLR, Cologne DM 13,20

An evaluation procedure for the determination of dynamic characteristics from flight test data was developed. The procedure uses a gradient method for the evaluation of eigenvalues and a regression method for the calculation of eigenvectors. The procedure was programmed in FORTRAN and was successfully applied during a handling qualities assessment of a fighter aircraft. The procedure is described and some results from both simulation and flight testing are presented. Author (ESA)

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N78-14045# Arizona State Univ., Tempe. Dept. of Educational Psychology.
ASSESSING INSTRUMENT SENSITIVITY FOR HEADING AND ATTITUDE INFORMATION Interim Report
Raymond W. Kulhavy, Richard F. Schmid, and Raymond S. Dean Aug. 1977 15 p refs
(Contract F41609-75-C-0028)
(AD-A046065; AFHRL-TR-77-2) Avail: NTIS HC A02/MF A01 CSCL 01/4

The three studies, described in this report, concerned the assessment of procedures which influence instrument sensitivity in military flight instruction. The ability to determine the relative location of an in-flight vehicle from a set of dial indicators was influenced more by students' expectations than by context. Sensitivity to heading and attitude information was increased when learners were supplied with overt attention control. The teaching of instrument sensitivity appears best facilitated by employing publicly observable responses during training, and seems to be a function of the degree to which the learner can be directed to use a spacial processing mechanism during initial encoding. Author (GRA)

N78-14046# Elliott-Automation Space and Advanced Military Systems Ltd., Camberley (England).
AVIONICS AND THE MRCA
J. E. Daboo 1977 27 p Presented at I.E.E., 16 Mar. 1977 Avail: NTIS HC A03/MF A01

A broad description of the avionics system of the Multi Role Combat Aircraft (MRCA), now known as the Tornado, is given and some aspects of the avionics development activities and of the management organization in the multinational environment are mentioned. The emphasis is on the avionics for the primary interdiction/strike role. The MRCA project has been undertaken jointly by the United Kingdom, the Federal Republic of Germany, and Italy. The major facilities provided by the avionics system are navigation, weapon delivery, automatic flight control, communications/identification, navigation/approach aids, defensive aids, recording, and checkout/monitoring. ESA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N78-14047*# Solar Turbines International, San Diego, Calif.
WIDE RANGE OPERATION OF ADVANCED LOW NOx COMBUSTORS FOR SUPERSONIC HIGH-ALTITUDE AIRCRAFT GAS TURBINES Technical Report, Nov. 1975 - Aug. 1977
P. B. Roberts and R. J. FioRito Oct. 1977 44 p
(Contract NAS3-19770)
(NASA-CR-135297; RDR-1817-22) Avail: NTIS HC A03/MF A01 CSCL 21E

An initial rig program tested the Jet Induced Circulation (JIC) and Vortex Air Blast (VAB) systems in small can combustor configurations for NOx emissions at a simulated high altitude, supersonic cruise condition. The VAB combustor demonstrated the capability of meeting the NOx goal of 1.0 g NO2/kg fuel at the cruise condition. In addition, the program served to demonstrate the limited low-emissions range available from the lean, premixed combustor. A follow-on effort was concerned with the problem of operating these lean, premixed combustors with acceptable emissions at simulated engine idle conditions. Various techniques have been demonstrated that allow satisfactory operation on both the JIC and VAB combustors at idle with CO emissions below 20 g/kg fuel. The VAB combustor was limited by flashback/autoignition phenomena at the cruise conditions to a pressure of 8 atmospheres. The JIC combustor was operated up to the full design cruise pressure of 14 atmospheres without encountering an autoignition limitation although the NOx levels, in the 2-3 g NO2/kg fuel range, exceeded the program goal. Author

N78-14048# Advisory Group for Aerospace Research and Development, Paris (France).

TECHNICAL EVALUATION REPORT ON THE 49TH(B) PROPULSION AND ENERGETICS SPECIALISTS MEETING ON POWER PLANT RELIABILITY

G. P. Sallee (Pratt and Whitney Aircraft Group, East Hartford, Conn.) Nov. 1977 11 p refs Meeting held at The Hague, 31 Mar. - 1 Apr. 1977

(AGARD-AR-110; ISBN-92-835-0207-8) Avail: NTIS HC A02/MF A01

The following observations reflect the tone of the meeting and the major results: (1) Engine reliability is not satisfactory in either commercial or military services. In particular the newer commercial engines are not living up to operators expectations. (2) It seems that civil and military authorities are considering the promulgation of more stringent requirements and standards concerning the development, certification/qualification and acquisition of future engines with respect to the reliability requirements that must be met. (3) Manufacturers are designing for improved maintainability and employing improved testing techniques to expose problems early. Further progress is contingent on the availability of engineering data on actual engine usage in military service. Detailed part failure data is needed to determine the causes for part failure with respect to usage and the relationships that exist between the various modes of failure. (4) The economic impact of military engine unreliability has not been discussed. The cost consequences of premature engine removals, aborts, part failures, etc., are needed to establish the role of engine reliability in engine life cycle cost. (5) The growth of engine health monitoring in the commercial airlines and the increased experimentation of such approaches in the military are indicative of the serious consequences of poor engine reliability. The future growth/potential for such techniques is impressive. Author

N78-14049# Douglas Aircraft Co., Inc., Long Beach, Calif.

STUDY TO IMPROVE AIRFRAME TURBINE ENGINE ROTOR BLADE CONTAINMENT Final Report

C. O. Gunderson Jul. 1977 234 p

(Contract DOT-FA76WA-3843)

(AD-A046255; MDC-J7615; FAA-RD-77-44) Avail: NTIS HC A11/MF A01 CSCL 21/5

Energies and trajectories for a range of fan, compressor, and turbine blade fragments from high bypass ratio fan engines used in typical 3 and 4 engine wide body airplanes were evaluated. The weight for local armor was established. The effects of fan blade fragment impacts for areas up to 30 deg forward of the fan plane of rotation were investigated. Simulated titanium blade fragments and various inlet and nacelle materials were used in tests to determine energy absorption capabilities. The effects of fragment impact angles, size, and rotation and penetration characteristics with steel and aluminum honeycomb; sheet steel; multiple steel layers; and Kevlar aramid fiber material containment systems were explored. The effect of added weight for airframe installed armor on fuel burned and fuel cost was estimated. In view of the adequacy of prevailing installation practices, further armor for the range of fragments considered would not appear to significantly enhance flight safety. Author

N78-14050# North Carolina State Univ., Raleigh. Engineering Design Center.

EFFECT OF INLET DISTORTION ON PERFORMANCE OF A COMPRESSOR STAGE. PART 1. PNEUMATIC DATA

L. W. Hardin, W. C. Griffith, J. N. Perkins, and F. O. Carta Apr. 1977 117 p

(Contract F44620-76-C-0055)

(AD-A046055; NCSU/EDC-77-1; AFOSR-77-1238TR) Avail: NTIS HC A06/MF A01 CSCL 13/7

An experimental investigation into the effects of inlet distortion on an isolated turbomachine rotor was conducted. The data obtained from pneumatic instrumentation was analyzed to gain insight into both the overall stage performance and the flow field of an individual rotor blade. The results indicate that the unsteadiness introduced by the distortion increases blade normal force and stage pressure rise. While undergoing inlet distortion, it was found that the rotor does not locally follow the undistorted pressure loss characteristic. Entry into rotating stall results in an abrupt decrease in the stage pressure rise. A definite hysteresis loop is evident for the stalling and unstalling of the rotor. A more complete understanding of the inlet distortion and rotating stall phenomena requires unsteady measurements which will be discussed in a subsequent report. Author (GRA)

N78-14051# Southwest Research Inst., San Antonio, Tex. Army Fuels and Lubricants Research Lab.

ENGINE LUBRICANT REQUIREMENTS FOR REMOTELY PILOTED VEHICLES (RPV) Final Report

H. W. Marbach, Jr. and John A. Russell Sep. 1977 28 p refs

(Contract DAAK02-73-C-0221)

(AD-A046238; AFLRL-85) Avail: NTIS HC A03/MF A01 CSCL 11/8

The Army is exploring the feasibility of using Remotely Piloted Vehicles (RPV's) in a multi-mission role. Powerplants for these RPV's are to be small, two-stroke, air-cooled, reciprocating engines which require a fuel/oil mix for operation. As no federal or military specification lubricant exists for this application, this report details results of an analytical/experimental investigation to evaluate the suitability of existing MIL SPEC lubricant classes for Army RPV use. GRA

N78-14052# Advisory Group for Aerospace Research and Development, Paris (France).

TECHNICAL EVALUATION REPORT ON THE 49TH(A) PROPULSION AND ENERGETICS PANEL SPECIALISTS' MEETING ON SECONDARY FLOWS IN TURBOMACHINES

K. Papailiou (Ecole Centrale de Lyon) Nov. 1977 11 p refs Meeting held at The Hague, 28-30 Mar. 1977

(AGARD-AR-109; ISBN-92-835-1263-4) Avail: NTIS HC A02/MF A01

Problems dealing with secondary flows in turbomachinery were investigated in a total of fifteen invited papers and seven short presentations, followed by a round table discussion. Theoretical works covered earlier research on secondary flow effects in compressors and turbines. Most of the presentations described experimental results. Techniques used include probe surveys, laser velocimetry, and several forms of flow visualization. Author

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N78-14053 Princeton Univ., N. J.

EFFECTS OF CONTROL AND DISPLAY PARAMETERS ON PILOTED VTOL DECELERATING INSTRUMENT APPROACH Ph.D. Thesis

Jean Victor Lebacqz 1977 252 p

Avail: Univ. Microfilms Order No. 77-19176

The influence of aircraft control system and displayed information characteristics on VTOL descending decelerating instrument transitions is discussed. The guidance relationships for a representative terminal area VTOL task, consisting of a constant (0.05g) decelerating transition on a steep glide slope (7.5 degrees) from 100 knots to the hover completely on instruments, are developed, including the need for and design of velocity commands which switch from air-referenced to ground-referenced, and a configuration change command. It is found that a trade-off in terms of pilot rating exists between control system complexity and display sophistication for generic levels of each, that explicit display of translational velocity information is required for satisfactory flying qualities regardless of control augmentation, and that an angular-rate-augmentation-only control system is unsatisfactory regardless of displayed information level. Dissert. Abstr.

N78-14054*# Lehigh Univ., Bethlehem, Pa. Dept. of Mechanical Engineering and Mechanics.

AIRCRAFT MODEL PROTOTYPES WHICH HAVE SPECIFIED HANDLING-QUALITY TIME HISTORIES Final Report

S. H. Johnson Jan. 1978 51 p refs

(Grant NsG-4005)

(NASA-CR-143848) Avail: NTIS HC A04/MF A01 CSCL 01C

Several techniques for obtaining linear constant-coefficient airplane models from specified handling-quality time histories are discussed. The pseudodata method solves the basic problem, yields specified eigenvalues, and accommodates state-variable transfer-function zero suppression. The algebraic equations to be solved are bilinear, at worst. The disadvantages are reduced generality and no assurance that the resulting model will be airplane like in detail. The method is fully illustrated for a fourth-order stability-axis small motion model with three lateral handling quality time histories specified. The FORTRAN program which obtains and verifies the model is included and fully documented. Author

N78-14055*# Boeing Commercial Airplane Co., Seattle, Wash.
FLIGHT CONTROL ELECTRONICS RELIABILITY/ MAINTENANCE STUDY
W. W. Dade, R. H. Edwards, G. T. Katt, K. L. McClellan, and H. A. Shomber Dec. 1977 364 p refs
(Contract NAS1-13654)
(NASA-CR-145271; D6-46346) Avail: NTIS HC A16/MF A01 CSCL 01C

Collection and analysis of data are reported that concern the reliability and maintenance experience of flight control system electronics currently in use on passenger carrying jet aircraft. Two airlines B-747 airplane fleets were analyzed to assess the component reliability, system functional reliability, and achieved availability of the CAT II configuration flight control system. Also assessed were the costs generated by this system in the categories of spare equipment, schedule irregularity, and line and shop maintenance. The results indicate that although there is a marked difference in the geographic location and route pattern between the airlines studied, there is a close similarity in the reliability and the maintenance costs associated with the flight control electronics. Author

N78-14056# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
MILITARY TRANSPORT (C-141) FLY-BY-WIRE PROGRAM Final Report, Sep. 1972 - May 1974
James A. Lackey Mar. 1977 63 p
(AD-A046163; ASD-TR-77-8) Avail: NTIS HC A04/MF A01 CSCL 01/3

The C-141 Fly-By-Wire Test Program was an in depth study of the control laws and parameters governing large transports handling qualities. The test aircraft was C-141A S/N 61-2779 belonging to the 4950th Flight Test Wing, Wright-Patterson Air Force Base, Ohio. This aircraft was modified to include a dual redundant Fly-By-Wire Flight Control System in parallel with the standard manual flight control system. The aircraft was flown using a side stick controller located on the copilot's right armrest. The FBW Flight Control System was a two axes system, pitch and roll. No yaw control was provided, except through the auto-pilot, where coordinated roll to yaw inputs to the FBW Flight Control System were made. The C-141 FBW system had three modes of operation; a rate command mode and two attitude hold modes, attitude command and control-stick steering. GRA

N78-14057# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
AN EXPOSITION ON AIRCRAFT RESPONSE TO ATMOSPHERIC TURBULENCE USING POWER SPECTRAL DENSITY ANALYSIS TECHNIQUES Final Technical Report, Oct. 1975 - Aug. 1976
Elijah W. Turner May 1977 73 p refs
(AF Proj. 1367)
(AD-A046108; AFFDL-TR-76-162) Avail: NTIS HC A04/MF A01 CSCL 01/3

The traditional power spectral density design procedure is reviewed. The evolution of modeling atmospheric turbulence is traced from the discrete gust to the present continuous representation. The modeling of an aircraft structure as a lumped parameter linear system excited by oscillatory air forces is outlined, and solutions to the resulting equations of motion are indicated. Expressions for the number of exceedances of specified load levels are presented and compared for stationary Gaussian turbulence and for stationary Gaussian patch turbulence. The motivation for modeling atmospheric turbulence as a nonstationary process is addressed, and several models for nonstationary turbulence are reviewed. Author (GRA)

N78-14058# Instrument Flight Center, Randolph AFB, Tex.
THREE-CUE HELICOPTER FLIGHT DIRECTOR EVALUATION
Jul. 1977 89 p
(AD-A046261; USAFIFC-TR-77-3) Avail: NTIS HC A05/MF A01 CSCL 01/4

This report covers the work accomplished during an inflight investigation concerning the evaluation of the changes in pilot performance, control activity and biochemical changes while flying with various display configurations of a helicopter Three-Cue Flight Director System. Flights were conducted in the TH-1F helicopter. The subject pilots participating in the study consisted of both instructor pilots and pilots attending the Instrument Pilot Instructor School (IPIS). GRA

N78-14059# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
CONTROL LAW DESIGN TECHNIQUES
W. Hofmann, G. Kreisselmeier, and R. Sharma May 1977 36 p refs Presented at the AGARD Lecture Ser. No. 89 on Task-oriented Flight Control Systems, London, 9-10 Jun. 1977 and Dayton, Ohio, 14-15 Jun. 1977
(DLR-IB-552-77/15) Avail: NTIS HC A03/MF A01

The high performance demands of modern flight systems require the design of task-oriented flight control systems. In this contribution, several control law design techniques which can be applied to the design of linear flight controllers are reviewed. Typical considerations and constraints which have to be taken into account by the flight control designer are stated. Frequency domain and state-space based time domain design techniques are discussed with special regard to their facilities and limitations. The design of longitudinal flight controllers is treated as an example. Author (ESA)

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N78-14060*# Massachusetts Inst. of Tech., Cambridge. Aerophysics Lab.
APPLICATION OF DIGITAL CONTROL TO A MAGNETIC MODEL SUSPENSION AND BALANCE SYSTEM Final Report, 1 Apr. 1976 - 30 Nov. 1977
Peter B. Luh, Eugene E. Covert, H. Philip Whitaker, and Charles W. Haldeman Dec. 1977 120 p refs
(Grant NsG-1292)
(NASA-CR-155515; MIT-TR-198) Avail: NTIS HC A06/MF A01 CSCL 14B

The feasibility of using a digital computer for performing the automatic control functions for a magnetic suspension and balance system for use with wind tunnel models is investigated. Modeling is done using both NASA-MIT prototype MSBS and a one-dimensional magnetic balance. A microcomputer using the Intel 8080 microprocessor is described and results are given using this microprocessor to control the one-dimensional balance. Hybrid simulations for one degree of freedom of the MSBS were also performed and are reported. It is concluded that use of a digital computer to control the MSBS is eminently feasible and should extend both the accuracy and utility of the system. Author

N78-14061# Fortifikationsfoervaltningen, Stockholm (Sweden).
ON MEASURED PRESSURES AND RUNNING TIMES OF SHOCK WAVES IN TNT-CHARGED SHOCK TUBES
Hans R. W. Weibull 1 Dec. 1975 75 p refs

(F-103-44) Avail: NTIS HC A04/MF A01

Shock waves generated by TNT charges of different weights detonated in tunnels or tubes of different sizes were studied and compared with shock waves not disturbed by tubes. Running times, distances run, and front pressures were collected from the literature. The diameters of the tubes ranged from 0.05 m to 6.0 m. The weights of the TNT charges ranged from 1.5 g to 500 kg. Scaling laws are discussed and the collected values of running times and distances run were reduced to a tube with a diameter of 1.0 m and to a charge weight of 1.0 kg of TNT. The collected values were compared with well-known, physically deduced equations and polynomials. The deviations from these equations are a measure of the accuracy of the measurements. Author (ESA)

N78-14062# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.

THE GENERATION OF MOTION CUES ON A SIX-DEGREES-OF-FREEDOM MOTION SYSTEM

M. Baarspul Jun. 1977 110 p refs

(VTH-LR-248) Avail: NTIS HC A06/MF A01

The mathematical formulation of motion cue generation on a six-degree-of-freedom motion base is described. From the mathematical model of the simulated aircraft, the specific forces and rotational accelerations at the aircraft c.g. are determined as primary control inputs to the motion drive laws. Because the specific forces act on the pilot inside the simulator cockpit, they should be transformed to the centroid location of the motion system. As the motion possibilities of the moving platform are constrained, filtering of the specific forces and rotational accelerations is necessary. As far as possible, tilt angles are used to reproduce sustained specific forces, providing the motion system with coordinated washout. The scaled equations as programmed in the digital computer, including values for the time constants and damping ratio of the motion filters as applied to the KSS B-747 flight simulator, are presented. The listing of the main motion program for the SDS Sigma 2 computer of this flight simulator is also given. Author (ESA)

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

N78-14063*# General Dynamics/Convair, San Diego, Calif.

CONCEPTUAL DESIGN FOR SPACELAB TWO-PHASE FLOW EXPERIMENTS

R. D. Bradshaw and C. D. King Dec. 1977 88 p refs

(Contract NAS3-20389)

(NASA-CR-135327; CASD-NAS-77-025) Avail: NTIS HC A05/MF A01 CSCL 22A

KC-135 aircraft tests confirmed the gravity sensitivity of two phase flow correlations. The prime component of the apparatus is a 1.5 cm dia by 90 cm fused quartz tube test section selected for visual observation. The water-cabin air system with water recycle was a clear choice for a flow regime-pressure drop test since it was used satisfactorily on KC-135 tests. Freon-11 with either overboard dump or with liquid-recycle will be used for the heat transfer test. The two experiments use common hardware. The experimental plan covers 120 data points in six hours with mass velocities from 10 to 640 kg/sec-sq m and qualities 0.01 to 0.64. The apparatus with pump, separator, storage tank and controls is mounted in a double spacelab rack. Supporting hardware, procedures, measured variables and program costs are defined. Author

N78-14064# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.

MISSION DESCRIPTION FOR A MULTIDISCIPLINARY LIDAR SYSTEM IN SPACELAB [AUFGABENBESCHREIBUNG FUER EIN MULTIDISZIPLINAERES LIDAR-SYSTEM IN SPACELAB]

W. Renger and G. H. Ruppersberg Aug. 1975 14 p refs In GERMAN

(DLR-IB-553-75/11) Avail: NTIS HC A02/MF A01

Results of a questionnaire on laser remote sensing application in Spacelab are given. The following subjects are covered: altimetry, Mie and Rayleigh scattering, resonance scattering, determination of surface properties, resonance absorption, differential absorption, and Raman scattering. The proposals of the various German partners with respect to Spacelab lidar are reviewed. A proposal for a multidisciplinary lidar system is made. ESA

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N78-14065 Michigan Univ., Ann Arbor.

FUNCTION SPACE QUASI-NEWTON TECHNIQUES WITH APPLICATION TO SPACE SHUTTLE TRAJECTORY OPTIMIZATION Ph.D. Thesis

Ernest Robert Edge 1977 160 p

Avail: Univ. Microfilms Order No. 77-17986

Two existing function space quasi-Newton algorithms, Davidon and projected gradient, are modified so that they may handle directly control variable inequality constraints. A third quasi-Newton algorithm developed by C. G. Bryoden is extended to include optimal control problems. The Bryoden algorithm is further modified so that it may handle directly control variable inequality constraints. The quasi-Newton methods along with a steepest descent and two conjugate gradient algorithms are simulated on three relatively simple yet representative bounded control problems, two of which possess singular subarcs. Overall, the Broyden algorithm was found to be superior. The most notable result of the simulations was the clear superiority of the Broyden and Davidon algorithms in producing a sharp singular control subarc. Dissert. Abstr.

N78-14066*# Analytical and Computational Mathematics, Zurich (Switzerland).

AN ANALYTICAL SATELLITE ORBIT PREDICTOR (ASOP)

Stephan E. Starke Oct. 1977 105 p refs

(Contract NAS9-15171)

(NASA-CR-151583; JSC-13094; Rept-77-FM-50) Avail: NTIS HC A06/MF A01 CSCL 22A

The documentation and user's guide for the Analytical Satellite Orbit Predictor (ASOP) computer program is presented. The ASOP is based on mathematical methods that represent a new state-of-the-art for rapid orbit computation techniques. It is intended to be used for computation of near-earth orbits including those of the shuttle/orbiter and its payloads. Author

N78-14067# Aerospace Corp., El Segundo, Calif. Engineering Science Operations.

NONLINEAR OPTIMAL TRAJECTORIES USING SUCCESSIVE LINEARIZATION

C. Hecht 28 Jun. 1977 16 p refs

(Contract F04701-76-C-0077)

(AD-A046068; TR-0077(9990)-5) Avail: NTIS HC A02/MF A01 CSCL 16/2

A method of designing trajectories for maneuvering reentry vehicles is developed in this paper. Optimal control theory using linear perturbation guidance and a quadratic penalty function is employed to design trajectories for these vehicles. The vehicle equations of motion are represented by a five-dimension state vector. The problem is formulated by linearizing about a reference trajectory. A linear servomechanism problem, rather than a regulator problem, is solved, leading to a Riccati matrix differential equation and an auxiliary vector differential equation which are solved backwards in time. Successive linearization consists of iteratively generating new trajectories by linearizing about a reference trajectory created from a prior iteration. The cost function is adjusted between iterations to shape the trajectory. Qualitative guidelines for selecting these cost functions are given. Test cases are shown, with emphasis on designing a trajectory to intercept a target point. Author (GRA)

N78-14068# Sandia Labs., Albuquerque, N. Mex.

NONLINEAR METHOD FOR PARAMETER IDENTIFICATION

APPLIED TO A TRAJECTORY ESTIMATION PROBLEM
D. G. Hull and W. E. Williamson 1977 8 p refs Presented at 4th AIAA Atmos. Flight Mech. Conf., Hollywood, Fla., 8 Aug. 1977
(Contract EY-76-C-04-0789)
(SAND-77-0065C; Conf-770809-1) Avail: NTIS HC A02/MF A01

The trajectory estimation problem is formulated as a parameter identification problem. The performance index is that of weighted least squares, and the unknown parameters are the initial conditions of the trajectory and the parameters which are used to represent the aerodynamic constants or functions. The optimization problem is solved using a square-root variable-metric algorithm. The derivatives needed by the optimization algorithm are computed numerically. Finally, the nonlinear equation method is used to compute the initial state and drag coefficient history of a reentry vehicle using simulated radar data. ERA

N78-14069# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
ORBITAL PLANE DRIFT MANEUVERS FOR TWIN-LAUNCHED EARTH OBSERVATION SATELLITES [UNTERSUCHUNGEN UEBER BAHNEBENEN DRIFT MANOEVER FUER ZWILLINGS-GESTARTETE ERDBEOBACHTUNGSSATELLITEN]
Alfred E. Pietrass 28 Apr. 1977 19 p refs In GERMAN
(DLR-IB-552-77/12) Avail: NTIS HC A02/MF A01

Satellite drifts were investigated for a tangential impulse, a normal impulse, and a combination of both. The impulses were applied to twin-launched satellites to attain a nodal difference between the two polar orbits. In order to attain a nodal difference of 90 deg in 90 days, the propulsion requirement for an initial 1100 km circular orbit is 2.6 km/s. Such extremely powerful orbital maneuver systems appear too heavy for launch vehicles. The maneuvers can therefore be considered for fine km per second orbit adjustment. ESA

N78-14070# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
ORBIT DETERMINATION ERROR ANALYSIS FOR SATELLITE-SATELLITE/GROUND TRACKING SYSTEMS
C. K. Rajasingh (Indian Space Research Organ., Bangalore, India) 27 May 1977 45 p refs
(DLR-IB-552-77/14) Avail: NTIS HC A03/MF A01

A statistical error analysis was made for the orbit determination process, where the observations from ground stations and/or from some orbiting spacecrafts, employed for tracking, are used. The various errors included in the analysis are errors in the tracking systems, uncertainty in the orbit model, inaccuracies of the ground station coordinates, and errors in the orbital elements of the tracking satellites. The orbital accuracy is computed in terms of the errors in the elements as well as in position and velocity along the trajectory. All errors and uncertainties are represented by covariance matrices. The computer program ODEAS, developed for this purpose is also presented.
Author (ESA)

N78-14071# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).
ERRORS IN ORBIT DETERMINATION OF ARTIFICIAL SATELLITES [FEHLERBETRACHTUNGEN BEI DER BAHNBESTIMMUNG KUENSTLICHER SATELLITEN]
R. DeRiz Dec. 1976 34 p In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(Rept-10-76) Avail: NTIS HC A03/MF A01

The influence of position measurement errors upon determination of satellite orbital parameters and the effect of errors in orbital parameters on the prediction of satellite positions are numerically evaluated. All calculations refer to a representative number of various trajectories. An expectation window is defined for an area in space in which an investigated satellite may be picked up again one period later. The influence of the measured data variance upon size scattering of the expectation window is statistically considered. Author (ESA)

N78-14072# European Space Agency, Paris (France).
DETERMINATION OF THE MOST EFFICIENT UTILIZATION OF THE GEOSTATIONARY ORBIT FOR COMMUNICATION SATELLITES USING A SYSTEM MODEL BASED ON SHARED CHANNEL INTERFERENCE MEASUREMENTS WITH PSK MODULATED SIGNALS
T. Hentrich and G. Zorbach Nov. 1977 30 p refs Transl. into ENGLISH of 'Untersuch. zur bestmoeglichen Ausnutzung der geostationaeren Satellitenbahn fuer Nachrichtensatelliten anhand eines Systemmodelles auf der Grundlage von Gleichkanal-Stoerbeeinflussungsmessungen mit PSK-modulierten Signalen', Fernmeldetech. Zentralamt, Darmstadt, West Ger. Report FTZ-445-TBr-15, Apr. 1977 Original report in GERMAN previously announced as N78-11183
(ESA-TT-427; FTZ-445-TBr-15) Avail: NTIS HC A03/MF A01

A systems model was used to determine the shared channel interference of a PSK (phase shift keying) modulated signal by up to four PSK modulated noise signals; the minimum distance at which a maximum allowable interference occurs was found for neighboring communication satellites, working in the same frequency range. The quantitative measure for interference used was the degradation Delta C/N (db) as a function of carrier-to-interferer ratio C/I (db) for certain bit error rates. Results show that the magnitude of occurring degradation is determined in essence by both direct neighbor satellites and that the degradation has a clear threshold value characteristic dependent on C/I or the corresponding angular decoupling lambda of the neighbor satellites. ESA

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N78-14073*# Rensselaer Polytechnic Inst., Troy, N. Y. School of Engineering.
ANALYSIS AND DESIGN OF A CAPSULE LANDING SYSTEM AND SURFACE VEHICLE CONTROL SYSTEM FOR MARS EXPLORATION Final Report
D. G. Gisser, D. K. Frederick, and S. W. Yerazunis 30 Jun. 1977 68 p refs
(Grant NGL-33-018-981)
(NASA-CR-155357; RPI-TR-MP-54) Avail: NTIS HC A04/MF A01 CSCL 22B

A number of problems related to unmanned exploration of planets or other extraterrestrial bodies with Mars as a case in point were investigated. The design and evaluation of a prototype rover concept with emphasis on mobility, maneuverability, stability, control and propulsion is described along with the development of terrain sensor concepts and associated software for the autonomous control of any planetary rover. Results are applicable not only to the design of a mission rover but the vehicle is used as a test bed for the rigorous evaluation of alternative autonomous control systems. Author

N78-14074# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
SHORT COURSE ON GROUND OPERATIONS SYSTEMS FOR GEOSTATIONARY SATELLITES. ORBIT DETERMINATION ERROR ANALYSIS
A. Leibold Sep. 1976 75 p refs Prepared for Indian Space Res. Organ., Bangalore
(DLR-IB-552-76/19) Avail: NTIS HC A03/MF A01

The problem of orbit determination accuracy is discussed for geostationary satellites, based on the weighted least squares method. Topics discussed include the estimation of orbital elements and other unknown parameters, bias and covariance matrix of the estimator, an orbit model for error analysis, and a weighing scheme of achieved orbit determination accuracy for

orbital maneuver design. An application to the transfer and primary orbit of the Symphonie satellites is described. ESA

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N78-14075 Stanford Univ., Calif.
A THEORETICAL ANALYSIS OF A RELATIVITY MISSION WITH TWO COUNTER-ORBITING DRAG-FREE SATELLITES Ph.D. Thesis
David Barry Schaechter 1977 184 p
Avail: Univ. Microfilms Order No. 77-18246

An experiment designed to accurately measure a dynamic effect of the general theory of relativity employs two counter-orbiting drag-free satellites in nearly identical circular, polar orbits at an altitude of 800 km. This configuration distinguishes between the non-relativistic perturbations (which produce opposite effects on the satellites) and the relativistic Lense-Thirring effect (which drags the ascending nodes of both of the satellites eastward at a rate of 6 meters/year). Satellite-to-satellite Doppler ranging measurements are made as the satellites pass each other near the earth's poles. Smoothing these measurements gives the relative orbital perturbations to millimeter precision. Ground tracking over the entire orbital paths gives the node locations to 10 centimeter precision for a 2.5 year experiment. The two satellite experiment provides a mechanism for distinguishing the relativistic effect from the nonrelativistic effects. Dissert. Abstr.

N78-14076# Naval Surface Weapons Center, Dahlgren, Va.
ORBIT COMPUTATION PROCEDURES FOR NAVSTAR GEODETIC POSITIONING SYSTEM SATELLITES FOR SATRACK APPLICATION Final Report
Sep. 1977 21 p refs
(AD-A046021; NSWC/DR-TR-3634) Avail: NTIS HC A02/MF A01 CSCL 16/2

Procedures required to provide precise ephimerides for Geodetic Positioning System (GPS) satellites are described. The ephimerides predicted will be used as source data for the determination of one's precise position in three dimensions to 10 m accuracy anywhere in the world. Signals from these satellites will also be used to determine the trajectory of fleet ballistic missiles. GRA

N78-14077# Emmanuel Coll., Boston, Mass.
CALIBRATION OF THE SSJ/3 SENSOR ON THE DMSP SATELLITES Technical Report, 1 Apr. - 1 Sep. 1977
Alan Huber, John Pantazis, A. L. Besse, and P. L. Rothwell
Sep. 1977 44 p refs
(Contract F19628-76-C-0039)
(AD-A045997; AFGL-TR-77-0202; SR-2) Avail: NTIS HC A03/MF A01 CSCL 14/2

The sensor is designed to measure electrons from 50 eV to 20 keV. This is accomplished by using two head assemblies with common signal processing and voltage sources. The low-energy head assembly selects 50.0 to 1,000 eV electrons over eight channels with a normalization factor H = 0.000-043 sq cm ster. The high-energy assembly similarly selects 1.00 to 20.0 keV electrons over eight channels with an H-factor equal to 0.000013 sq cm ster. Energy resolution is approximately 10% for an isotropic incident flux. An electron beam was used to determine angular and energy response. These measurements were compared with results from a Monte-Carlo computer code and approximate analytic methods to determine the final normalizations. Author (GRA)

N78-14078# Directorate of Aerospace Studies, Kirtland AFB, N. Mex.
SURVIVE: A COMPUTER MODEL FOR SINGLE PENETRATOR/SURFACE-TO-AIR MISSILE ATTRITION Final Report
A. Foster Cooper Jul. 1977 73 p
(AD-A046112; DAS-TR-77-14) Avail: NTIS HC A04/MF A01 CSCL 01/3

This report discusses the theory and operation of the SURVIVE computer model for evaluating the probability of survival of a single penetrator flying in an environment defended by surface-to-air missile systems. SURVIVE was developed in support of the Utility Evaluation of Stand-Off Missile Candidates study. Author (GRA)

N78-14079# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
DESIGN OF AN ATTITUDE CONTROL SYSTEM FOR AN ASTRONOMICAL RESEARCH SATELLITE M.S. Thesis - Tech. Univ. Munich
Gerhard K. Heimbold 30 Mar. 1976 139 p refs In GERMAN; ENGLISH summary
(DLR-IB-552-76/2) Avail: NTIS HC A07/MF A01

For an astronomical satellite designed to explore cosmic gamma ray, in the range 1 to 20 MeV, the implementation of either spin axis stabilization or three axis stabilization using pure jet control torquing was investigated. A configuration model of the satellite was developed to show dynamic conditions and the influence of the disturbing torques. The performance parameters of the subsystems were computed. The costs of both attitude control systems were compared by means of cost factors. It is proposed to apply spin stabilization to the astronomical satellite. Author (ESA)

N78-14080# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
SHORT COURSE ON GROUND OPERATIONS SYSTEMS FOR GEOSTATIONARY SATELLITES. TRACKING AND ORBIT DETERMINATION
A. Leibold Sep. 1976 42 p refs Prepared for Indian Space Res. Organ., Bangalore
(DLR-IB-552-76/18) Avail: NTIS HC A03/MF A01

Theory and operational aspects of the ELKORR program developed at DFVLR for orbit determination are described. Required orbit determination accuracies are specified for orbital maneuvers and tracking accuracies. The theory covers the weighted least squares method and the intended Kalman filter. Orbit perturbations are dealt with. The operational orbit determination is related to the Symphonie satellites. ESA

N78-14081# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
SHORT COURSE ON GROUND OPERATIONS SYSTEMS FOR GEOSTATIONARY SATELLITES. STATION KEEPING (SYMPHONIE)
A. Leibold Oct. 1976 29 p refs Prepared for Indian Space Res. Organ., Bangalore
(DLR-IB-552-76/20) Avail: NTIS HC A03/MF A01

The theory of stationkeeping is presented, and the operational stationkeeping of Symphonie is described. Orbit correction strategies are based on either minimum fuel consumption or optimization of the time between two necessary orbit correction maneuvers. The effects of perturbations due to triaxiality of the earth's shape, solar and lunar gravitation, and solar radiation pressure are taken into account. ESA

N78-14082# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
DYNAMIC MODEL OF A THREE AXIS STABILIZED GEOSTATIONARY SATELLITE WITH FLEXIBLE SOLAR ARRAYS IN NORMAL OPERATION
G. K. Heimbold 16 Mar. 1977 129 p refs In GERMAN; ENGLISH summary
(DLR-IB-552-77/7) Avail: NTIS HC A07/MF A01

The equations of motion were derived from the total system energy by application of Lagrange's method. Structural flexibility was introduced into the system equations in a hybrid coordinate formulation, i.e., a combination of discrete and distributed (modal) coordinates. Some simulation results of the whole system using a digital computer numerical integration are shown. Author (ESA)

N78-14083# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.

POST-FLIGHT ESTIMATION OF 'FIREFLY' ROCKET TRAJECTORY PARAMETERS FROM A FEW OPTICAL OBSERVATIONS

J. H. Jerger (J.H. Jerger Assoc., Newport Beach, Calif.) and A. E. Pietrass 2 May 1977 32 p refs

(DLR-IB-552-77/11) Avail: NTIS HC A03/MF A01

A postflight estimation of trajectory parameters is described for a Nike-Apache rocket with a Firefly payload for testing metal ion cloud release techniques, based on optical observations of impact range, impact azimuth, and apogee altitude. The observations were fitted to the trajectory model so as to minimize an error criterion. A man-in-the-loop curve fitting technique was applied. The nominal trajectory was stored. Look azimuth and look elevation of a perturbed trajectory were plotted as well as the pertinent observations. Perturbation parameters were iteratively improved so as to result in a best fit. ESA

N78-14084# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.

WIND AND TARGETING EVALUATION, POST FLIGHT PERFORMANCE OF THE ARIES SOUNDING ROCKET FOR IMS-PORCUPINE-2

Alfred E. Pietrass 23 May 1977 61 p refs

(DLR-IB-552-77/13) Avail: NTIS HC A04/MF A01

Methods and procedures applied in IMS-Aries preflight trajectory evaluation and targeting are summarized. Aries is the Minuteman 1 second stage. Esrange wind information, and preliminary postflight trajectory data are presented. The rocket was launched March 20, 1977, at 19:22:00 U.T. from Esrange, Kiruna, Sweden, carrying the Porcupine-2 payload. Flight performance was nominal, characterized by 460 km apogee altitude, 11.5 min flight time, and 59 km impact range. ESA

N78-14085# Centre National d'Etudes Spatiales, Toulouse (France).

TEST SYSTEM FOR EARTH OBSERVATION - SPOT. VOLUME 2: MULTIMISSION PLATFORM, PLATFORM DESIGN [SYSTEME PROBATOIRE D'OBSERVATION DE LA TERRE SPOT. VOLUME 2. PLATEFORME MULTIMISSIONS CONCEPTION DE LA PLATEFORME]

Mar. 1977 167 p In FRENCH 5 Vol.

Avail: NTIS HC A08/MF A01

Constraints on the spacecraft configuration are outlined. They are linked to the multimission aspect for various payloads, to the launch vehicle (Ariane), and to the ground network. Four different orbital configurations are discussed and compared, resulting in the selection of one of these, based on solar generator and attitude control subsystem criteria. Levels of modularity are reviewed and two solutions are retained: semi-modular and completely modular. These designs are examined from points of view of mechanical interfaces with payload, test facilities, and solar generator. The aspect of flexibility with respect to payloads is analyzed. Electrical and thermal design are discussed. ESA

N78-14086# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

STUDY OF A DRAG-FREE SATELLITE ORBIT CONTROL

Huu Thanh Huynh, Anne-Marie Mainguy, Christian Marchal, and Jean-Pierre Marec 1977 91 p refs In FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-429)

(ONERA-NT-1976-11) Avail: NTIS HC A05/MF A01

Theoretical problems pertaining to the control of a pre-established orbit were considered. The analysis of the orbital motion was performed with regard to the evaluation of the orbital perturbations due to the drag compensation system and errors in the earth potential model. A trajectography study was carried out for the geopotential phase with a view to determining a locally improved model of the earth potential then, during the operational phase, to observing the satellite position departure from ephemerides. Two correction procedures are proposed in a slow and fast mode. From the results it is possible to foresee the feasibility of an economical control system capable of ensuring that the satellite will follow within 25 m ephemerides suitably established for periods of 30 days ahead. ESA

N78-14087# Centre National d'Etudes Spatiales, Toulouse (France).

THEORETICAL AND EXPERIMENTAL PROGRAM FOR THE STUDY OF LF DYNAMIC STRUCTURAL BEHAVIOR OF THE ARIANE LAUNCH VEHICLE [PROGRAMME THEORIQUE ET EXPERIMENTAL RETENU POUR L'ETUDE DU COMPORTEMENT DYNAMIQUE STRUCTURAL BASSE FREQUENCE DU LANCEUR ARIANE]

Michel Verdrenne Apr. 1977 40 p refs In FRENCH; ENGLISH summary

(CNES-NT-11) Avail: NTIS HC A03/MF A01

The methodology chosen for the characterization of the dynamic behavior of the European launch vehicle, Ariane, which makes up a coherent system of theoretical and experimental means and of design criteria set up at the beginning of the program is presented. Author (ESA)

N78-14088 This accession not used.

N78-14089# Centre National d'Etudes Spatiales, Toulouse (France).

MECHANICAL ADAPTATION OF SIGNE 3 SPACECRAFT TO A SOVIET LAUNCHER [ADAPTATION MECANIQUE DU SATELLITE SIGNE 3 SUR UN LANCEUR SOVIETIQUE]

Lucien Gosset Jun. 1977 60 p In FRENCH; ENGLISH summary

(CNES-NT-73) Avail: NTIS HC A04/MF A01

It was initially intended to launch the Signe 3 spacecraft (final version of D2B satellite model for a gamma astronomy mission) using the French Diamant BP 4 launcher. Because the vibration specifications of the Soviet launcher are much tougher, a damping system was designed and developed. Author (ESA)

N78-14989# European Space Agency, Paris (France).

PREDICTION OF THE RAIN EROSION OF SLIP-CAST FUSED SILICA RADOMES FOR HIGH VELOCITY MISSILES

Daniel Balageas *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-3 (ESA-TT-415) Sep. 1977 p 1-11 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-3, May-Jun. 1977 p 133-137 Original report in FRENCH previously announced as A77-38743 (For availability see N78-14988 05-99)

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N78-14090*# Systems Research Lab., Champaign, Ill.

DIGITAL CONTROLLER DESIGN: ANALYSIS OF THE ANNULAR SUSPENSION POINTING SYSTEM Bimonthly Report

1 Dec. 1977 34 p refs

(Contract NAS8-32358)

(NASA-CR-150486; Rept-1-7-ED-07418-1F) Avail: NTIS HC A03/MF A01 CSCL 22B

The annular suspension and pointing system (ASPS) a payload

auxiliary pointing device of the space shuttle is briefly described along with the function of the digital controller. The equations of motion of a simplified plan planar model of the ASPS are derived. Results of computer simulations are discussed. J.M.S.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

No abstracts in this category.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N78-14091# European Space Agency, Paris (France).
QUALIFICATION OF THERMAL CONTROL COATINGS FOR ULTRAVIOLET AND PARTICLE RADIATION IN SPACE
A. Paillous Jun. 1977 183 p refs Transl. into ENGLISH of 'Qualification des Revetements de Controle Thermique aux Rayonnements Ultraviolets et Particulaires de l'Espace', ONERA, Toulouse Report ONERA-DERTS-29/4025/TS, Jul. 1975 Original report in FRENCH previously announced as N78-11352
(ESA-TT-387; ONERA-DERTS-29-4025-TS) Avail: NTIS HC A09/MF A01

The solar reflectance degradation of nine types of thermal control coatings was investigated during a simulated 7-year exposure to the environment encountered in geosynchronous orbit by the north and south facing parts of the OTS satellite. Irradiations and measurements were carried out under secondary vacuum at 90 C. A simultaneous exposure to ultraviolet radiation in the 200 to 380 nm range, to electrons at 200 keV, and to protons at 40 and 150 keV was achieved. The test principles, materials used, operating conditions, and results are described. Modeling of the degradations as a function of time is proposed.
Author (ESA)

N78-14092# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Aeroelastik.
DYNAMIC RESPONSE ANALYSIS OF SPACECRAFT STRUCTURES BASED ON MODEL SURVEY TEST DATA INCLUDING NONLINEAR DAMPING
Manfred Degener 29 Apr. 1977 59 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-431)
(DLR-FB-77-17) Avail: NTIS HC A04/MF A01; DFVLR, Cologne DM 29,20

Theoretical and experimental methods to determine the dynamic response of a spacecraft to the loads acting at the structure during launch and mission were compared. As one of the possible methods the general procedure of dynamic response calculations on the basis of experimental data, measured in a modal survey test, is presented. Special emphasis is given to the importance of the nonlinear damping behavior, which must be taken into account; for the dynamic response analysis. It is shown that the modal survey test turns out to be a good method to measure the nonlinear characteristic. By introducing these data into the calculations a reliable dynamic response analysis can be performed. The results are illustrated for some examples.
Author (ESA)

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N78-14093# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
GEOS S 331 FLUX-GATE MAGNETOMETER
M. Candidi, S. Cantarano, G. Ferri, F. Mariani, G. Martinelli, R. Orfei, C. Signorini, and G. Vannaroni Mar. 1977 51 p refs (LPS-77-10) Avail: NTIS HC A04/MF A01

The S 331 magnetometer experiment for the GEOS satellite is described. Full details are given both of the design and of the interfaces. The operating characteristics are quoted.
Author (ESA)

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N78-14094*# Rocketdyne, Canoga Park, Calif.
TRIPROPELLANT ENGINE STUDY
D. B. Wheeler 9 Dec. 1977 61 p
(Contract NAS8-32613)
(NASA-CR-150482; ASR77-240; BMPR-2) Avail: NTIS HC A04/MF A01 CSCL 21H

The feasibility of modifying the space shuttle main engine (SSME) for dual mode operation was investigated. Various high power cycle engine configurations derived from the SSME were configurations that will allow sequential burning of LOX/hydrocarbon and LOX/hydrogen were studied in order to identify concepts that make maximum use of SSME hardware and best satisfy the dual mode booster engine system application. Engine cycles were formulated for LOX/RP-1, LOX/CH4, and LOX/C3H8 propellants. Flow rates and operating cycles were established and the adaptability of the major components of the SSME was evaluated.
Author

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N78-14095# Connecticut Univ., Storrs. Environmental Engineering Program.
AN INDEX OF REFRACTORY ORGANICS Final Report, Jul. 1974 - Jun. 1976
T. B. Helfgott, F. L. Hart, and R. G. Bedard Aug. 1977 143 p
(Grant EPA-R-803231-01-05)
(PB-272438/3; EPA-600/2-77-174) Avail: NTIS HC A07/MF A01 CSCL 07D

Refractory waterborne organics resist biodegradation, accumulate in the environment and can inhibit life forms. Laboratory techniques for, and interpretations of, a Refractory Index (R.I.) were developed to quantitatively assess the persistency of refractory organics and uses R.I. to evaluate some 38 industrial, natural and combined organics. Since negative R.I. values are of qualitative significance only, a biological inhibition value was developed and used to quantitatively assess those organics found to interfere with the biochemical tests used, long-term ultimate

Warburg Respirometer determinations. In a few cases, confirmation of the R.I. interpretation was performed using a model activated sludge unit and by specific analysis. Author

24 COMPOSITE MATERIALS

Includes laminates.

N78-14096* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INTUMESCENT COATINGS CONTAINING 4,4'-DINITROSULFANILIDE Patent
Paul M. Sawko and Salvatore R. Riccitiello, inventors (to NASA) Issued 6 Dec. 1977 10 p Filed 22 Oct. 1976 Supersedes N77-11119 (15 - 02, p 0160)
(NASA-Case-ARC-11042-1; US-Patent-4,061,579; US-Patent-Appl-SN-734902; US-Patent-Class-252-8.1; US-Patent-Class-60-836) Avail: US Patent Office CSCL 11D

A coating which is stable to the environment and to exposure to water, and which intumesces at a favorable temperature was developed. The composition comprises a mixture of 4, 4 prime dinitrousulfanilide as the intumescent agent in a polymer binder mixture of a chlorinated polyolefin, a bisphenol A epoxy resin, and a rubber-like amine hardener.
Official Gazette of the U.S. Patent Office

N78-14097 British Library Lending Div., Boston Spa (England).
X-RAY METHODS OF TESTING GRAPHITE PRODUCTS
K. Pawlowski Oct. 1977 10 p refs Transl. into ENGLISH from Koks Smola Gaz (Poland), v. 4, 1977 p 122-124
(BLL-RTS-10930) Avail: British Library Lending Div., Boston Spa, Engl.: £7.59; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

A method is presented for the study of the crystalline structure of refined carbon products subjected to the process of graphitizing. The proposed X-ray methods of investigation permit an estimate of the primary structure of cast, unpowdered samples. A discussion is given of the method of Fourier analysis, the measurement of inter-layer distance, the degree of graphitizing and the role of rhombohedral' modification in the study of the crystalline structure of three selected graphite materials. Author

N78-14098 British Library Lending Div., Boston Spa (England).
FRACTURE MECHANICAL INVESTIGATION OF BONDING IN METAL - CERAMIC COMPOSITES
G. Elssner and R. Pabst Feb. 1977 11 p refs Transl. into ENGLISH from High Temp.-High Pressures (West Ger.), v. 6, no. 3, 1974 p 321-327 Presented at the 8th Plansee Seminar, Reutte, Austria, 27-30 May 1974
(BLL-PO-3438-(9022.81)) Avail: British Library Lending Div., Boston Spa, Engl.

The fracture mechanics of metal/ceramic laminates were studied. These laminates were produced by solid state bonding niobium to alumina in a high vacuum at temperatures above 1400 C without formation of an intermediate layer. The microstructure and the intrinsic chemical compatibility of the composite samples are briefly described. The fracture resistance of notched bend specimens is described in terms of the stress intensity factor which depends on external and internal parameters such as welding conditions and microstructure. The influence of the microstructure of the ceramic component on the fracture resistance of the laminates is supported by scanning electron microscope photographs of the fracture surfaces. Author

N78-14099*# General Electric Co., Cincinnati, Ohio.
IMPACT RESISTANT BORON/ALUMINUM COMPOSITES FOR LARGE FAN BLADES
T. L. Oller, C. T. Salemme, J. H. Bowden, G. S. Doble, and P. Melnyk Dec. 1977 127 p ref
(Contract NAS3-19729)
(NASA-CR-135274; R77AEG667) Avail: NTIS HC A07/MF A01 CSCL 11D

Blade-like specimens were subjected to static ballistic impact testing to determine their relative FOD impact resistance levels. It was determined that a plus or minus 15 deg layup exhibited good impact resistance. The design of a large solid boron/aluminum fan blade was conducted based on the FOD test results. The CF6 fan blade was used as a baseline for these design studies. The solid boron/aluminum fan blade design was used to fabricate two blades. This effort enabled the assessment of the scale up of existing blade manufacturing details for the fabrication of a large B/Al fan blade. Existing CF6 fan blade tooling was modified for use in fabricating these blades. Author

N78-14100# Atlantic Research Corp., Alexandria, Va.
GRADED PYROLYTIC GRAPHITE/SILICON CARBIDE COATING DEPOSITION STUDIES Final Report, Jul. 1974 - Oct. 1975
Joseph P. Copeland and Kenneth E. Undercoffer Apr. 1977 154 p ref
(Contract F33615-74-C-5103; AF Proj. 7340)
(AD-A046000; AFML-TR-76-122) Avail: NTIS HC A08/MF A01 CSCL 11/3

Codeposited coatings of pyrolytic graphite/silicon carbide were fabricated by chemical vapor deposition at temperatures ranging from 3000 F to 3800 F using methane and methyltrichlorosilane as precursors and nitrogen as a diluent and carrier. The effects of temperature and methyltrichlorosilane concentration on coating composition (SiC content) and morphology were determined. Specimens of codeposited coatings were fabricated to determine the physical properties, thermal stress state and erosion characteristics of various PG/SiC compositions. Coating samples were examined and characterized microscopically, by X-ray diffraction and by electron microprobe. Author (GRA)

N78-14101# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
THE SHEAR PROPERTIES OF UNIDIRECTIONAL CARBON FIBRE REINFORCED PLASTICS AND THEIR EXPERIMENTAL DETERMINATION
D. Purslow London Aeron. Res. Council 1977 89 p refs Supersedes RAE-TR-76093; ARC-37132
(ARC-CP-1381; RAE-TR-76093; ARC-37132) Avail: NTIS HC A05/MF A01; HMSO £3.50; PHI $13.45

Various techniques for the prediction and measurement of the shear strength and stiffness of unidirectional carbon fiber composites have been compared and evaluated. It is concluded that the shear modulus, but not the shear strength, may be predicted with sufficient accuracy for most practical purposes. Methods for the experimental determination of shear modulus and strength are recommended. Author (ESA)

N78-14102# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Abt. Mechanische Beanspruchung.
THE INFLUENCE OF NITRIDING CONDITIONS ON MICROSTRUCTURE AND MECHANICAL PROPERTIES OF REACTION BONDED SILICON NITRIDE
Juergen Heinrich and Manfred Boehmer 27 May 1977 32 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-439)
(DLR-FB-77-22) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 16,20

The dependence of microstructure and the resulting mechanical properties of reaction bonded silicon nitride on density, composition, and pressure of nitriding gas, as well as alpha/beta-ratio, were determined. These processing parameters strongly influence microstructure. Flexural strength is primarily determined by the total porosity and, in cases of identical total porosity, by the pore size. Author (ESA)

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also 77 *Thermodynamics and Statistical Physics*.

N78-14103 British Library Lending Div., Boston Spa (England).
DETERMINATION OF THE SURFACE FREE ENERGY OF SOLIDS FROM MEASUREMENTS OF THE CONTACT ANGLE
W. Wojcik Aug. 1977 19 p refs Transl. into ENGLISH from Wiad Chem. (Poland), v. 30, no. 4, 1976 p 223-235
(BLL-RTS-10717) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

The determination of the surface free energy of solids by using measurements of the contact angle is reviewed. The merits and demerits of various methods as well as their suitability for particular systems are discussed. Author

N78-14104* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AUTOMATIC MULTIPLE-SAMPLE APPLICATOR AND ELECTROPHORESIS APPARATUS Patent
Benjamin W. Grunbaum, inventor (to NASA) (Calif. Univ., Berkeley) Issued 6 Dec. 1977 7 p Filed 24 Nov. 1976 Supersedes N77-12157 (15 - 03, p 0305) Sponsored by NASA
(NASA-Case-ARC-10991-1; US-Patent-4,061,561; US-Patent-Appl-SN-744574; US-Patent-Class-204-299R; US-Patent-Class-204-180G) Avail: US Patent Office CSCL 07D

An apparatus for performing electrophoresis and a multiple-sample applicator is described. Electrophoresis is a physical process in which electrically charged molecules and colloidal particles, upon the application of a dc current, migrate along a gel or a membrane that is wetted with an electrolyte. A multiple-sample applicator is provided which coacts with a novel tank cover to permit an operator either to depress a single button, thus causing multiple samples to be deposited on the gel or on the membrane simultaneously, or to depress one or more sample applicators separately by means of a separate button for each applicator. Official Gazette of the U.S. Patent Office

N78-14105 British Library Lending Div., Boston Spa (England).
THE SEDIMENTATION STABILITY OF THIXOTROPIC FIRE-PROOF COATINGS
V. A. Chechulin, V. A. Gushchin, and F. S. Musin [1977] 11 p Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (USSR), v. 10, 1976 p 145-147 In RUSSIAN and ENGLISH
(BLL-M-25536-(5828.4F); Rept-423I) Avail: British Library Lending Div., Boston Spa, Engl.

The rheological properties of thixotropic fire proof coatings were represented by the Bingham-Shvedov equations for media, and were characterized by their plastic viscosity and static shearing stress. A procedure was proposed for calculating the maximum diameters of particles of refractory fillers which were sedimentationally stable in paints of the type under consideration. The thixotropic properties of fire proof paints based on bentonite and kaolonite suspensions were studied. It was found that bentonite and kaolinite gels with static shearing stresses of not less than 0.05 g/sq cm will keep refractory fillers with densities of up to 4 g/cu cm in a suspended state if their grain size composition is that usually employed for fire proof coatings.
Author

N78-14106 Virginia Polytechnic Inst. and State Univ., Blacksburg.
A MICROPROCESSOR BASED MULTIWAVELENGTH-DETECTOR SYSTEM FOR LIQUID CHROMATOGRAPHY Ph.D. Thesis
Christopher Andrew Titus 1976 268 p
Avail: Univ. Microfilms Order No. 77-20265

A multiwavelength-detector system for liquid chromatography was constructed using a state-of-the-art microprocessor and silicon linear photodiode array. By using a microprocessor, the control, data acquisition and data manipulation functions were alterable and flexible towards the optimization of a separation. The computer was used to digitize the anulog output of the linear array, subtract the dark current and then correct the data for the non-linear response of the detector and the non-linear emissivity of the light source. These last functions were required due to the single beam nature of the instrument. The entire (200 nm) spectrum could be displayed on a CRT display, the transmittance values of the user selected wavelengths punched on paper tape and plotted as a multi-trace recording on an X-Y plotter. Up to eight wavelengths could be monitored in this manner.
Dissert. Abstr.

N78-14107 Arizona Univ., Tucson.
THE BEAM-FOIL SPECTRA OF KRYPTON (2 TO 5 MeV) Ph.D. Thesis
Bartley Lowell Cardon 1977 207 p
Avail: Univ. Microfilms Order No. 77-18667

The usefulness of the beam-foil source for producing high quality spectral data was evaluated, and knowledge of the spectra in the fourth period of the periodic table was extended by recording the beam-foil spectra of krypton between 400 - 6000A. The Doppler broadening was reduced by refocusing the lens imaging techniques. The spectra were recorded with a McPherson 225 one-meter scanning monochromator. Special attention was given to determining the calibration of the spectrometer with the krypton spectra interposed with calibration scans of known nitrogen lines recorded under similar conditions. The incident krypton beam energies were 2, 3, 4, and 5 MeV. The photoelectric scans (intensity versus wavelength) were fitted by hand and with a Gaussian curve fitting program on the CDC 6400 computer. Approximately 650 nitrogen profiles established the spectrometer calibration to within an average uncertainty of plus or minus 0.3A.
Dissert. Abstr.

N78-14108 British Library Lending Div., Boston Spa (England).
STATISTICAL ALGORITHMS FOR DETECTING THE PEAK IN A CHROMATOGRAPHICAL SIGNAL
A. L. Gurevich, O. A. Lyubeznikov, and L. A. Rusinov Jul. 1977 10 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Priborostr. (USSR), v. 19, no. 3, 1976 p 109-115
(BLL-RTS-10681) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

Algorithms for detecting the peak and its characteristic points in the signal to be processed are presented. The algorithms are based on the method of verifying statistical hypotheses and the method of evaluating parameters and are applied to real time information processing.
J.M.S.

N78-14109 British Library Lending Div., Boston Spa (England).
SIMPLIFIED ADDITION METHOD IN ATOMIC ABSORPTION SPECTROMETRY
F. Balzar, J. Knecht, and G. Stork 2 Jun. 1977 13 p refs Transl. into ENGLISH from Z. Anal. Chem. (East Ger.), v. 287, no. 2, 1976 p 97-103
(BLL-CE-Trans-7024-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.

The addition method, also called the sigma-calibration method, is often used when only a small number of samples are available, if, due to the complex composition of the sample, a calibration curve cannot be obtained. It is also used in cases where the calibration parameters do not remain constant. The method discussed was carried out with the aim of simplifying the necessary laborious preliminary work in connection with the practical application of the sigma-calibration method in atomic absorption spectrometry. In order to determine an element in accordance with the known addition method, the sample solution is divided into three or four equal parts, and the same amount of a calibration solution is added to each. The added calibration solutions do of course contain different concentrations of the element to be determined. When determining several elements in one sample, this procedure becomes very laborious and time consuming, and standard solutions of different elemental concentrations must be prepared. With this simplified method all determinations of all the elements are carried out with only one sample. The errors are corrected by computer program.
Author

N78-14110 British Library Lending Div., Boston Spa (England).
APPLICATION OF GAS-SOLID CHROMATOGRAPHY FOR THE MEASUREMENT OF SMALL METALLIC SURFACES OF SOLID TEST PIECES
S. Thibault, J. Amouroux, and J. Talbot 1 Mar. 1977 12 p refs Transl. into ENGLISH from Bull. Soc. Chim. Fr. (France), no. 4, 1968 p 1319-1323

(BLL-OA-Trans-1510-(6196.3)) Avail: British Library Lending Div., Boston, Spa, Engl.

Surfaces of solid test pieces of Armco iron were measured by a gas-solid chromatography method. Apparent surfaces of 130 sq cm were easily determined. One application consisted of comparing the roughness of Armco iron plates polished mechanically by abrasive papers of different size grains. According to the conditions of polishing, the roughness varies from 1.3 to 4.5. Author

N78-14111 British Library Lending Div., Boston Spa (England).
SIGNIFICANCE OF RF VALUES IN ADSORPTION THIN LAYER CHROMATOGRAPHY
M. Marichy-Viricel and A. Lamotte [1977] 15 p refs Transl. into ENGLISH from Chromatographia (West Ger.), v. 10, no. 2, 1977 p 79-85
(BLL-M-24945-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

With the help of the methods suggested, it is possible to obtain the true RF value of a substance in thin layer chromatography. However these methods are more or less time consuming and the usefulness of the information open to question depending on the study objectives. The nonhomogeneity of the stationary and mobile phases along the developed plate, notably at its top and bottom is demonstrated; this nonhomogeneity becomes more important as the volatility of the mobile phases and their affinity for water increase. Author

N78-14112 Pennsylvania Univ., Philadelphia.
ULTRASONICALLY ENHANCED DIFFUSION OF MACROMOLECULES IN GELS Ph.D. Thesis
Nance Dicciani Kunz 1977 342 p
Avail: Univ. Microfilms Order No. 77-19877

The initial goal was to determine the feasibility and usefulness of study toward the development of a simple sound-sensitive film. A film similar in use to an X-ray plate which would incorporate the benefits of acoustic imaging but not the expense and complexity present in current methods would most assuredly have great practical value. With potential medical uses in mind, sonication conditions which would eliminate the possibility of cavitation were necessary, and for this reason, the study was limited to acoustic waves having high frequencies (>1 MHz) and low intensities (<1 w/sq cm). The known ability of ultrasound to enhance diffusion was chosen as the basis for the preliminary efforts to develop a sound detection system. These studies employed biological macromolecules, generally enzymes, as the diffusing/reacting species and nine different systems were examined with poly-acrylamide gels as the porous matrix. Dissert. Abstr.

N78-14113 State Univ. of New York, Buffalo.
A STUDY OF NICKEL OXIDE-CARBON COMPOSITES IN CO, CO2, AND N2 ATMOSPHERES Ph.D. Thesis
Mehmet Alaittin Hastaoglu 1977 161 p
Avail: Univ. Microfilms Order No. 77-19440

The coupled reaction system of NiO, C, CO, and CO2 was studied experimentally in the temperature range of 800 C to 1100 C. Separate experiments were conducted with NiO + CO, C + CO2, C + Ni + CO2, C + NiO + CO, C + NiO + N2, and C + NiO + CO2 systems with NiO/C molar ratio varying from 0.05 to 1.0. The catalytic effect of Ni on carbon gasification could be represented quantitatively. The activation energy was 44 kcal/gmole. This catalytic effect increased the gasification rate 3 to 70 times, but it was not high enough to explain the high rate of weight loss of the general system. Solid-solid reaction of NiO and C was considered and at initial reaction time the solid-solid rate constant was deduced under CO, CO2, and N2 atmospheres. The models that consider the gas solid reactions through gaseous intermedia are not applicable to this system mainly because the solid-solid reaction was neglected. Dissert. Abstr.

N78-14114 Minnesota Univ., Minneapolis.
STOCHASTIC ANALYSIS OF PARTICULATE SOLIDS MIXING AND SEGREGATION: NONSTATIONARY MARKOV CHAINS Ph.D. Thesis
Cheng-Hsing Chou 1977 176 p
Avail: Univ. Microfilms Order No. 77-78970

Mobilities of the components of systems of particulate polydisperse solids subjected to sinusoidal vertical vibration, and to shear were investigated by means of a stochastic analysis of induced changes in bed composition profiles. This was accomplished by measuring the composition distributions of particulates following periods of controlled vibration or shear. A finite, discrete, first-order, nonstationary Markov chain was used as the basis for the calculation of the probabilities of specific particle translocations within binary systems of particles. In a separate analysis of the data, the overall segregation rate constants and their corresponding specific mixing and segregation rate constants were calculated. This was accomplished by computing the standard deviations of the composition distributions from the mean bed composition. Equations derived from the concept of reversible first-order process were used as the basis for the calculation of these rate constants. Dissert. Abstr.

N78-14115 Carnegie-Mellon Univ., Pittsburgh, Pa.
ION AND ION PAIR TRANSPORT THROUGH LIQUID MEMBRANES Ph.D. Thesis
Michael Eugene Duffey 1977 143 p
Avail: Univ. Microfilms Order No. 77-19189

The transport of electrolytes through a synthetic organic liquid membrane was studied. The transport mechanism is simple and chemically well defined to show effects normally obscured by fast, selective systems. More specifically, electrolytes are transported across the membrane by simultaneous free ionic and associated ion paired mechanisms. A theory for ionic and ion paired transport is proposed. In a limiting case for binary electrolytes, two distinct transport regions are predicted in the same membrane by varying only the external electrolyte concentration. When the aqueous electrolyte concentration is low, ionic transport dominates and flux is proportional to concentration difference across the membrane. At high aqueous concentration, ion paired transport dominates and flux is proportional to concentration difference squared. The experimental results qualitatively and quantitatively confirm the proposed theory of simultaneous ionic and ion paired transport. Physical constants for the membrane were also determined. Dissert. Abstr.

N78-14116 State Univ. of New York, Buffalo.
REDUCTION OF HEMATITE WITH A HYDROGEN AND CARBON MONOXIDE GAS MIXTURE Ph.D. Thesis
Yehia A. El-Tawil 1977 153 p
Avail: Univ. Microfilms Order No. 77-19430

Experiments on the reduction process were carried out under conditions that the reaction was controlled by: (1) chemical kinetics, (2) pore diffusion, and (3) mass transfer across a boundary layer. Also, experiments on the reduction of nickel oxide with hydrogen and carbon monoxide gas mixture were carried out in the pore diffusion regime. The rate of reduction as well as the product solid structure were found to depend on gas composition. The rate of reaction exhibited a nonlinear dependence on the gas composition. The gas solid reaction was modelled using the Stefan-Maxwell equations for multicomponent gas diffusion. A comparison of this approach with the pseudobinary diffusion coefficient approach was made. The results showed that the use of the Stefan-Maxwell equations gave a better agreement with the experimental measurements. Dissert. Abstr.

N78-14117 Carnegie-Mellon Univ., Pittsburgh, Pa.
BOUNDARY EFFECTS IN THE TRANSPORT OF ARBITRARILY-SHAPED BROWNIAN PARTICLES Ph.D. Thesis
Lawrence J. Gajdos 1977 252 p
Avail: Univ. Microfilms Order No. 77-19191

Both hydrodynamic and direct interactions between the particles and the bounding surfaces are used to formulate boundary effects in the transport of arbitrary Brownian particles. Illustrative examples include the effect of dispersion forces on the orientation of an ellipsoid near a plane wall, and size and shape effects on particle dispersion in cylindrical and planar geometries. The particle dispersion problem is of interest in studying hindered diffusion in membranes, hydrodynamic chromatography (separation by flow) and flow-field fractionation. A technique for deriving dispersion results (Fourier analysis) is presented. Dissert. Abstr.

N78-14118 Washington Univ., Seattle.
TWO STATE COMBUSTION FOR BETTER COMBUSTION COMPLETENESS AND REDUCTION OF NITROGEN OXIDES EMISSION Ph.D. Thesis

Robert Jih-Chang Yang 1976 108 p
Avail: Univ. Microfilms Order No. 77-18446

This steady flow system consisted of two (fuel-rich and fuel-lean) stirred reactors connected via a heat exchanging section of variable effectiveness. The whole system was water-cooled. The fuels used were propane and hydrogen-carbon monoxide mixtures. The oxidant was air. The effects of fuel-air equivalence ratios, mean residence times of both stages and the range of inter-stage heat removal (simulating work extraction) were investigated. Theoretical calculations based on perfectly stirred reactor theory were carried out in order to correlate the experimentally measured data. Due to inadequate state-of-the-art knowledge, the chemical or kinetic mechanisms used in these calculations were modeled with the following restrictions: propane-air pyrolysis process was modeled as a reaction that produces carbon monoxide and hydrogen at an infinite rate. The only NO production mechanism used was the Zeldovich mechanism. Dissert. Abstr.

N78-14119*# West Virginia Univ., Morgantown. Coll. of Engineering.
FLUIDIZED BED COMBUSTOR MODELING
M. Horio, P. Rengarajan, R. Krishnan, and C. Y. Wen Jan. 1977 214 p refs
(Contract NAS3-19725)
(NASA-CR-135164) Avail: NTIS HC A10/MF A01 CSCL 21B

A general mathematical model for the prediction of performance of a fluidized bed coal combustor (FBC) is developed. The basic elements of the model consist of: (1) hydrodynamics of gas and solids in the combustor; (2) description of gas and solids contacting pattern; (3) kinetics of combustion; and (4) absorption of SO2 by limestone in the bed. The model is capable of calculating the combustion efficiency, axial bed temperature profile, carbon hold-up in the bed, oxygen and SO2 concentrations in the bubble and emulsion phases, sulfur retention efficiency and particulate carry over by elutriation. The effects of bed geometry, excess air, location of heat transfer coils in the bed, calcium to sulfur ratio in the feeds, etc. are examined. The calculated results are compared with experimental data. Agreement between the calculated results and the observed data are satisfactory in most cases. Recommendations to enhance the accuracy of prediction of the model are suggested. Author

N78-14120# Lockheed Missiles and Space Co., Palo Alto, Calif.
PROBLEM OF IGNITION OF HETEROGENEOUS SYSTEMS WITH CONDENSED PRODUCTS BY CONSTANT HEAT FLUX
V. P. Stovbun, V. V. Barzykin, and K. G. Shkadinskii [1977] 11 p refs Transl. into ENGLISH of doc. from the Inst. of Chem. Phys., Acad. of Sci. of the USSR, Chernogolovka, 21 Nov. 1975
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

Three areas of ignition of heterogeneous systems were studied: (1) single particle ignition of metals and wire in a high temperature gaseous oxidizer; (2) gas suspension ignition; and (3) ignition of pressed specimens, plates, monolithic blocks, and powders. Heat liberation function is a peculiarity of the problem of igniting compact heterogeneous systems. A theoretical model of a heterogeneous system, consisting of plane parallel layers of fuel and oxidizer, is presented. J.A.M.

N78-14121*# National Aeronautics and Space Administration, Washington, D. C.
A FEW WAYS OF CALCULATING THE SIMILARITY PARAMETER KAPPA* FOR REAL GASES
W. Lorenz-Meyer Dec. 1977 34 p refs Transl. into ENGLISH from of "Ueber einige Moelichkeiten zur Berechnung des aehnlichkeitsparameters kappa* bei Realen Gasen", DFVLR, Goettingen, West Ger., 1977 13 p Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-2790)
(NASA-TM-75222) Avail: NTIS HC A03/MF A01 CSCL 07D

In connection with the question on the applicability of test results obtained from cryogenic wind tunnels to the large-scale model the similarity parameter is referred to. A simple method is given for calculating the similarity parameter. From the numerical values obtained it can be deduced that nitrogen behaves practically like an ideal gas when it is close to the saturation point and in a pressure range up to 4 bar. The influence of this parameter on the pressure distribution of a supercritical profile confirms this finding. Author

N78-14122# Electricity Council Research Center, Capenhurst (England).
BEHAVIOUR OF SIMPLE HYDROCARBONS IN THE REGION OF HIGH POSITIVE POTENTIAL
J. G. Sunderland Jul. 1977 37 p refs
(ECRC/M1065) Avail: NTIS HC A03/MF A01

Experiments in which chemical analyses were used to detect oxidation products from a range of aliphatic hydrocarbons and benzene subjected to anodic oxidation on several electrodes are presented and experimental results discussed. For individual titles, see N78-14123 through N78-14124.

N78-14123# Electricity Council Research Center, Capenhurst (England).
OXIDATION OF OLEFINES
In its Behaviour of Simple Hydrocarbons in the Region of High Positive Potential Jul. 1977 p 3-10 refs (For availability see N78-14122 05-25)
Avail: NTIS HC A03/MF A01

The anodic oxidation of some simple hydrocarbons in the region of oxygen evolution on a variety of electrode materials have been studied. In acid media the olefins studied have hydrolyzed to the alcohol and it is these which have been anodically oxidized to the corresponding ketone rather than the parent olefin. In alkali no reaction is observed. The importance of the electro-active species and the functional group on their reactivity towards oxidation are discussed in the light of these findings.
Author (ESA)

N78-14124# Electricity Council Research Center, Capenhurst (England).
THE ANODIC OXIDATION OF BENZENE ON LEAD DIOXIDE IN SULPHURIC ACID
In its Behaviour of Simple Hydrocarbons in the Region of High Positive Potential Jul. 1977 p 11-23 refs (For availability see N78-14122 05-25)
Avail: NTIS HC A03/MF A01

The benzene oxidation to p-benzoquinone is shown to be an activation controlled process and to involve the adsorbed hydroxyl radical. Beta lead dioxide has been found to be the most effective electrode material for the production of p-benzoquinone and its role in directing the reaction is discussed.
Author (ESA)

N78-14125# National Bureau of Standards, Washington, D. C. Physical Chemistry Div.
STANDARD REFERENCE MATERIALS: ENTHALPY AND HEAT CAPACITY STANDARD REFERENCE MATERIAL: MOLYBDENUM SRM 781, FROM 273 TO 2800 K Final Report
D. A. Ditmars, A. Cezairliyan, S. Ishihara, and T. B. Douglas Sep. 1977 83 p refs
(PB-272127/2; NBS-SP-260-55; LCCN-77-608175) Avail: NTIS HC A05/MF A01 CSCL 07D

The relative enthalpy of NBS Standard Reference Material No. 781 (99.95 mass-percent pure, polycrystalline molybdenum: a metallic, high-temperature enthalpy and heat-capacity standard) was measured with two differently designed, receiving type calorimeters in the temperature ranges 273 to 1173 K and 1173 to 2100 K, respectively. The smoothed enthalpy data derived from these measurements are believed to have an inaccuracy not exceeding 0.6 percent at any temperature in these ranges. The heat capacity of Standard Reference Material No. 781 was also measured in the temperature range 1500 to 2800 K using a millisecond - resolution pulse technique with resistive self-heating. Author

N78-14126# Massachusetts Inst. of Tech., Cambridge. Lab for Insulation Research.
DIELECTRIC CONSTANT AND LOSS DATA, PART 3 Final Report, 1 Jul. 1974 - 1 Jan. 1977

William B. Westpahl May 1977 71 p
(Contract F33615-75-C-5020; AF Proj. 7371)
(AD-A046172; AFML-TR-74-250-Pt-3) Avail: NTIS HC A04/MF A01 CSCL 20/12

The main body of this report lists dielectric constant and loss data on materials measured in this laboratory in the period 1 July 1974 through 31 December 1976, together with measurements techniques and calculations. The index following the data section is intended to be a complete reference to dielectric measurement data of this laboratory to date.
Author (GRA)

N78-14127# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
FUNDAMENTALS OF WETTING AND BONDING BETWEEN CERAMICS AND METALS
Joseph A. Pask 21 Jan. 1977 34 p refs Presented at Conf. on the Fundamentals of Wetting and Bonding Between Ceram. and Metals, Bethesda, Md., 24 Jan. 1977
(Contract W-7405-eng-48)
(LBL-6028; Conf-770114-1) Avail: NTIS HC A03/MF A01

The conditions and the reactions that lead to the realization of chemical equilibrium at interfaces and thus to chemical bonding is discussed with specific attention to the platinum/glass and gold/glass systems. Wetting of the solid by the liquid and formation of an interface are part of the problem. Sessile drop experiments and their interpretation are included. ERA

N78-14128# Ames Lab., Iowa.
INTERACTIONS OF HYDROGEN WITH ETHYLENE AND ETHANE ON IRIDIUM Ph.D. Thesis
P. R. Mahaffy Jun. 1977 99 p refs
(Contract W-7405-eng-82)
(IS-T-758) Avail: NTIS HC A05/MF A01

In an effort to determine the details of reaction mechanisms, kinetic parameters were obtained for the following two catalytic reactions, C2H4 + H2 yields C2H6 and C2H6 + H2 yields 2 CH4. The first reaction was carried out, for the most part, under reaction conditions (e.g. 110-200 K) which prevent complications caused by a side reaction, the surface hydrogenation of adsorbed ethylene. The second reaction was carried out at somewhat higher temperatures (80 to 200 C). Both reactions were studied in the pressure range 0.5 to 1000 microns. Extensive isotope labeling experiments were also performed, which together with the kinetic measurements support in a self-consistent way the following mechanisms of hydrogen addition. The adsorbed species C2H5(a) and H(a) were found to be intermediates in both the hydrogenation and hydrogenolysis reactions. In the case of the hydrogenation reaction, the rate limiting step was found to be the irreversible addition of an adsorbed hydrogen atom to an adsorbed ethylene molecule to produce C2H5(a) which is further hydrogenated to produce ethane. ERA

N78-14129# California Univ., Livermore. Lawrence Livermore Lab.
BULK QUENCHING OF HYDROCARBON OXIDATION IN AN EXPANDING COMBUSTION CHAMBER
O. I. Smith, C. K. Westbrook, and R. F. Sawyer May 1977 49 p refs Presented at Tech. Meeting of the Canadian Sect. of the Combust. Inst., Banff, Canada, 26 May 1977
(Contract W-7405-eng-48)
(UCRL-79580; Conf-770561-1) Avail: NTIS HC A03/MF A01

The propagation of premixed methane-air flames was investigated in an enclosure designed to simulate conditions encountered in an internal combustion engine. The apparatus provides full optical access to the combustion process. Flame speeds are extracted from high speed schlieren motion pictures of the combustion process. Cases involving flame propagation in constant and expanding volume ducts are analyzed for a range of reactant mixtures from stoichiometric to the lean flammability limit. Emphasis is placed on experimental conditions where incomplete hydrocarbon combustion in the bulk gas (as opposed to the thermal boundary layer) due to quenching of hydrocarbon oxidation reactions by volume expansion is observed. Results of one dimensional modeling of the combustion process for a phi = 0.86 mixture over a wide range of expansion rates are presented. ERA

N78-14130# European Space Research and Technology Center, Noordwijk (Netherlands). Product Assurance Div.
FLAMMABILITY TESTING
Paris ESA 1 Oct. 1976 23 p
(ESA-PSS-26/QRM-21T-Issue-1) Avail: NTIS HC A02/MF A01

The equipment and procedures to be employed in initial screen tests of the flammability properties of materials intended for use in a manned space vehicle are presented. Test methods include critical oxygen index (based on ASTM D-2863): downward propagation test; determination of the flash and fire point (based on ASTM D-1929) and electrical wire insulation and accessory flammability test (based on NHB 8060.1.test4). ESA

N78-14131# Institut Franco-Allemand de Recherches, St. Louis (France).
EXPERIMENTAL STUDY OF NON-STEADY PHENOMENA ASSOCIATED WITH THE COMBUSTION OF SOLID GUN PROPELLANTS
G. Klingenberg and H. Mach 31 Aug. 1976 10 p refs Presented at the 16th MIT Intern. Symp. on Combustion, Cambridge, Mass., 15-20 Aug. 1976
(ISL-CO-213/76) Avail: NTIS HC A02/MF A01

The mathematical models for describing the gasdynamic process occurring within gun tubes proposed by Heiser using holographic methods, and Krauth using Lagrange coordinates were studied. The temperature distribution of luminous powder gas flow within the bore, and the muzzle exit plane of 20 mm guns was measured. It was found that radial flow gradients occur which accumulate unburned solidified combustion products near the inner tube wall, and that the assumption of complete burning must be modified. ESA

N78-14132# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
PAIR CORRELATION IN SIMPLE POLAR LIQUIDS
G. Stell (State Univ. of New York, Stony Brook) and J. J. Weis Dec. 1976 15 p refs Sponsored in part by the US NSF and Petroleum Res. Fund
(LPTHE-76/30) Avail: NTIS HC A02/MF A01

For a system of dipolar hard spheres, comparisons are made among new Monte Carlo results and the results of several approximation schemes developed to describe the pair correlation function in simple dipolar liquids. A self-consistent Ornstein-Zernike approximation proposed by Hoeye and Stell gives results that appear to be nearly exact for all values of dipole moment at which relevant Monte Carlo results are currently available. Results are also given for a linear approximation, the higher order cluster series approximation of Verlet and Weis, and an approximation of Hoeye and Stell based on the use of a Pade approximant for the thermodynamics. Author (ESA)

N78-14133# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Inst. fuer Reaktionskinetik.
EMISSION SPECTROSCOPICAL INVESTIGATION OF THE SYSTEM F2-H2 IN A SHOCK TUBE
G. Rimpel Mar. 1976 138 p refs In GERMAN; ENGLISH summary
(DLR-IB-453-76/1) Avail: NTIS HC A07/MF A01

In a shock tube, Ar-F2-H2-mixtures containing 0.2% H2 were heated up to temperatures of approx. 830 and 940 K, respectively. The pressures amounted to 4.0 and 3.6 bar, respectively. The ensuing reaction was observed via the radiation emission of the vibrational excited HF-molecules in the spectral range from 660 to 960 nm. From these measurements the population numbers of discrete vibrational levels (v = 3,...,9) of the HF-molecule were determined. Chemical kinetic calculations were carried out in order to evaluate, from these measurements, information on rate coefficients of certain elementary reactions. By adapting the calculations to the measurements it was found that VVT-processes between HF and HF do occur much faster at higher vibrational quantum numbers than originally supposed. Furthermore, statements could be made on VT-processes

between HF and Ar as well as on the pumping reaction H + F2 yields HF + F. Author (ESA)

N78-14134# Benedict Coll., Columbia, S. C.
DETERMINATION OF TRACE METALS IN EFFLUENTS BY DIFFERENTIAL PULSE STRIPPING VOLTAMETRY
James T. Kinard Jul. 1977 50 p refs
(Grant EPA-R-803490)
(PB-272258/5; EPA-600/4-77-034) Avail: NTIS HC A03/MF A01 CSCL 07D

Differential pulse anodic stripping voltametry was evaluated to determine its applicability to industrial and domestic effluents. The results show that trace amounts of zinc, cadmium, lead, bismuth, copper, thallium, indium, antimony, tin and nickel can be determined individually and simultaneously. A procedure for providing low blank buffer and electrolyte systems was tested. The efficiency for the entire process, including digestion, sample transfer and analysis, was found to range from 93 to 100%. Pulse anodic stripping voltametry was found to be superior to atomic absorption in terms of sensitivity, detection limits and cost. GRA

N78-14135# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
PROVISIONAL THERMODYNAMIC FUNCTIONS OF PROPANE, FROM 85 TO 700 K AT PRESSURES TO 700 BAR
Robert D. Goodwin Jul. 1977 240 p refs Sponsored in part by American Gas Association, Inc., Arlington, Va.
(PB-272355/9; NBSIR-77-860) Avail: NTIS HC A11/MF A01 CSCL 07D

Thermophysical properties of propane were tabulated at integral temperatures over the entire range of fluid states from 85 to 700 K along isobars to 700 bar. A modified form of the nonanalytic equation of state is employed for the first time. Thermodynamic functions for the compressed liquid were obtained by use of heats of vaporization from the boiling point to the critical point, such that the free energies of saturated liquid and vapor are equal. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N78-14136 Vanderbilt Univ., Nashville, Tenn.
REACTIONS OF COORDINATED MOLECULES Ph.D. Thesis
Jane Victoria Zeile 1977 155 p
Avail: Univ. Microfilms Order No. 77-19408

The reactivity of transition metal carbenoid complexes is first discussed, including the oxidation of several carbenoid complexes by four known oxidizing agents, pyridine-N-oxide, ceric ammonium nitrate, iodosobenzene and thioacetamide-S-oxide. The carbenoid ligand of the cationic molybdenum complex is a five membered ring containing an unusually reactive saturated carbon atom. This reactivity can be attributed to the oxonium ion character of the cyclic ligand. The complex reacts readily with a variety of alcohols, ethane thiol, secondary and tertiary amines, and sodium methoxide to afford a large number of new complexes some of which are cationic carbenoid complexes, and others of which are neutral acyl complexes. All complexes were fully characterized by spectrochemical and elemental analysis. Newly formed metallo-beta-diketonate complexes are then described. The synthesis and chemical characterization of the coordinated metallo-beta-diketonate complexes, which are analogous to the coordination compounds of acetylacetone where the methine group has been replaced by a metal carbonyl complex are discussed as well as the synthesis and chemical characterization of the enol tautomers of several metallo-beta-diketonate complexes. Dissert. Abstr.

N78-14137 British Library Lending Div., Boston Spa (England).
ON THE CORROSION OF CHEMICALLY DEPOSITED NICKEL-PHOSPHORUS COATINGS
J. Kovecses Oct. 1977 12 p refs Transl. into ENGLISH from Metalloberflache (West Germany), v. 31, no. 1, 1977 p 7-10
(BLL-RTS-10801) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 20 UK BLL photocopy coupons

Weathering and laboratory tests were carried out in order to determine the corrosion resistance of nickel-phosphorus coatings. Potential-time curves were plotted for different phosphorus-bearing coating in hydrogen peroxide solution and these showed that corrosion resistance depends on phosphorus content. A black film developing as a result of these investigations was found to primarily consist of nickel and phosphorus but also to contain local concentrations of copper and iron. Author

N78-14138 Pennsylvania Univ., Philadelphia.
MELT-SPINNING OF AMORPHOUS RIBBONS AND EFFECTS OF ANNEALING ON CURIE TEMPERATURE Ph.D. Thesis
Howard Horst Liebermann 1977 138 p
Avail: Univ. Microfilms Order No. 77-19882

Amorphous alloy ribbons produced in recent years by several variations of chill block melt-spinning were studied. Properties exhibited by amorphous alloy ribbons and the dependence of these properties on structure were investigated to optimize engineering properties and to gain a fundamental understanding of the materials. Dissert. Abstr.

N78-14139 Michigan Univ., Ann Arbor.
KINETICS OF GASEOUS OXYGEN ABSORPTION BY MOLTEN IRON AND SOME IRON ALLOYS Ph.D. Thesis
Ronald Henry Radzilowski 1977 251 p
Avail: Univ. Microfilms Order No. 77-18099

An experimental investigation of the rates of oxygen dissolution in molten iron and some Fe-Al, Fe-Si, Fe-Ti and Fe-V alloys was carried out in pure oxygen and oxygen-bearing gas mixtures. Three experimental techniques were employed: a modified constant-volume Sieverts' method, a falling droplet technique, and an electromagnetically levitated droplet method. The experimental work was divided into three parts: (1) a comparison was made between oxygen absorption from pure oxygen gas into liquid iron and that into liquid cobalt, copper, and nickel using the modified constant volume Sieverts' method; (2) the initial stage of reaction between pure oxygen and some molten iron alloys was studied by the falling droplet and constant volume Sieverts' methods; and (3) the effect of thermal diffusion in gas mixtures on oxygen absorption by liquid iron was investigated by the levitated droplet technique. Dissert. Abstr.

N78-14140 Rice Univ., Houston, Tex.
THE EARLY STAGE OF DEFORMATION IN TUNGSTEN, TANTALUM AND NICKEL SINGLE CRYSTALS Ph.D. Thesis
Dyonisio Garcia Pinatti 1977 150 p
Avail: Univ. Microfilms Order No. 77-19283

The Ta and W was oriented for maximum resolved shear stress on the [111] (101) system. Simultaneously microstrain and ultrasonic propagation measurements (attenuation and modulus defect) were performed at various stress bias in order to test details of theories concerning the preyield region and the flow stress in body-centered cubic refractory metals. The experimental results for annealed W are in close agreement with the theoretical predictions for the kink chain model over the string model for dislocation. It appears that double kink nucleation in nonscrew dislocations has negligible effect in this domain. The results for annealed Ta exhibited no stress bias effect on the ultrasonic propagation measurements, which suggest that the strong influence of impurities mask our ability to discern this fine structure for dislocation motion. Dissert. Abstr.

N78-14141 British Library Lending Div., Boston Spa (England).
NEW ALUMINUM ALLOYS FOR AUTOMOBILE BODY-WORK
R. Deschamps, R. Develay, and J. Peyraud 30 Mar. 1977 21 p refs Transl. into ENGLISH from Rev. Aluminum (Paris), no. 448, 1976 p 89-97
(BLL-Trans-1394-(9022.04)) Avail: British Library Lending Div., Boston Spa, Engl.

The steps in development of two light weight aluminum

alloys for use in automobile bodies are described. The first alloy called CP483 of the AlMgCu family, displayed improved mechanical properties of previous family members, and deep drawability. Improved weldability was also accomplished without impairing plastic properties. The second alloy developed was CP485 of the AlCuMgSi family whose advantages lie in processing characteristics, safety and basic metallurgical properties. B.L.P.

N78-14142 British Library Lending Div., Boston Spa (England).
THE EFFECTS OF THE POROSITY AND THE SINTERING MEDIUM ON THE CASE HARDENING AND CRITICAL POINTS OF IRON BASE METAL CERAMIC MATERIALS
S. S. Ermakov, G. T. Reznikov, and N. N. Kukushkin 25 May 1977 18 p refs Transl. into ENGLISH from Russian report (Leningrad) 18 p
(BLL-NEL-TT-2736-(6075.461)) Avail: British Library Lending, Div., Boston Spa, Engl.

The influence of the sintering environment on the depth of the case hardening of powdered metals of varied porosity was studied along with the effect of porosity on the critical points of iron base metal ceramic materials. It is shown that: (1) the case hardening of samples sintered in a gas atmosphere and with a 3-6% porosity the rate of carburization is lower than for nonporous material; (2) an increase in porosity increases the rate of carburization; (3) case hardening of samples sintered in vacuo takes place at a higher rate than for wrought samples or those sintered in gaseous media; (4) with continuous heating and cooling the critical points are displaced and the thermal hysteresis decreased; and (5) porosity increases the critical rate of quenching and reduces the hardenability. J.M.S.

N78-14143*# Ford Motor Co., Dearborn, Mich. Engineering and Research Staff.
FABRICATION OF THIN LAYER BETA ALUMINA
Gerald J. Tennenhouse [1977] 41 p refs
(Contract NAS3-19782)
(NASA-CR-135308) Avail: NTIS HC A03/MF A01 CSCL 11F

Beta alumina tubes having walls 700 microns, 300 microns, and 140 microns were processed by extrusion and sintering utilizing Ford proprietary binder and fabrication systems. Tubes prepared by this method have properties similar to tubes prepared by isostatic pressing and sintering, i.e. density greater than 98% of theoretical and a helium leak rate less than 3 x 10 to the -9th power cc/sq cm/sec. Ford ultrasonic bonding techniques were used for bonding beta alumina end caps to open ended beta -alumina tubes prior to sintering. After sintering, the bond was hermetic, and the integrity of the bonded area was comparable to the body of the tube. Author

N78-14144# Royal Aircraft Establishment, Farnborough (England).
EVALUATION OF THE QUALITY OF PICKLING AS A SURFACE PRE-TREATMENT IN ALUMINIUM BONDING
J. Peterka May 1977 14 p refs Transl. into ENGLISH from Adhaesion (West Berlin), v. 20, no. 1, 1976 p 3-7
(RAE-Lib-Trans-1904; BR59056) Avail: NTIS HC A02/MF A01

Means of pretreating aluminum surfaces were explored in order to increase the efficiency of the cohesive strength of adhesives. Aluminum surfaces degreased with acetone and pickled for various time periods were shown in electron microscope photographs at magnifications of up to 13,500 times. Pickling techniques were found effective in combating contamination resulting from adsorption of atmospheric components, thereby exploiting the full strength of new adhesives. B.L.P.

N78-14145# Aeronautical Research Labs., Melbourne (Australia).
MECHANISMS OF STRESS-CORROSION CRACKING AND LIQUID-METAL EMBRITTLEMENT, PARTICULARLY IN HIGH-STRENGTH ALUMINUM ALLOYS
S. P. Lynch Feb. 1977 27 p refs
(ARL/Mat-101; AR-000-234) Copyright. Avail: NTIS HC A03/MF A01

Metallographic and fractographic observations of sub-critical crack growth in a precipitation-hardened Al-Zn-Mg alloy in liquid-metal, aqueous, and water-vapor/air environments suggest that stress-corrosion cracking and liquid-metal embrittlement in this alloy involve a common mechanism. Sub-critical crack growth in all these environments can produce entirely dimpled fracture surfaces and, in liquid-metal and aqueous environments, crack growth can occur extremely rapidly. It is proposed that stress-corrosion cracking and liquid-metal embrittlement in aluminum alloys (and possibly other materials) can be explained on the basis that chemisorption of environmental species facilitates nucleation of dislocations at crack tips. Such a process would produce sub-critical crack growth with less blunting at crack tips than in inert environments and, hence, would explain observations that dimples on fracture surfaces after SCC are smaller and shallower than those on overload fractures. The results suggest that neither dissolution nor hydrogen-embrittlement processes occurred during stress-corrosion cracking in aluminum alloys. Author

N78-14146# Aeronautical Research Labs., Melbourne (Australia).
THE MECHANISM OF LIQUID-METAL EMBRITTLEMENT-CRACK GROWTH IN ALUMINUM SINGLE CRYSTALS AND OTHER METALS IN LIQUID-METAL ENVIRONMENTS
S. P. Lynch Feb. 1977 25 p refs
(ARL/Mat-102; AR-235) Avail: NTIS HC A02/MF A01

Metallographic and fractographic studies of fracture in single crystals of aluminium and zinc, and in polycrystalline aluminium, cadmium and tin in liquid-metal environments and in air are described. The commonly suggested mechanism for liquid-metal embrittlement--that chemisorption of liquid-metal atoms facilitates tensile rupture of stressed interatomic bonds at crack tips--is not supported by the present observations. Rather, observations of extensive slip around crack tips and dimpled fracture surfaces suggest that crack growth in embrittling liquid-metal environments occurs by plastic flow, but with considerably less blunting occuring at crack tips than in air. It is proposed that liquid-metal embrittlement can be explained on the basis that chemisorption of liquid-metal atoms facilitates the nucleation of dislocations at crack tips. Such an effect would produce sub-critical crack growth, change the distribution of slip around cracks and reduce the extent of blunting at crack tips, but would not generally influence bulk flow characteristics. The relevance of these results to hydrogen-embrittlement, stress-corrosion cracking, and ductile versus brittle behavior in general is discussed. Author

N78-14147# Office of Naval Research, London (England).
HYDROGEN-IN-METALS CONFERENCE
W. N. Cathey 21 Sep. 1977 12 p refs Conf. held at Paris, Jun. 1977
(AD-A046019; ONRL-C-7-77) Avail: NTIS HC A02/MF A01 CSCL 11/6

This report presents a review of a few important papers. Most of the papers were related to applied problems. In particular, problems of H-related damage to engineering alloys were treated extensively. In addition to work on H in pure metals such as Pd, Nb, and other transition metals, some work was also reported on H in alloys such as Nb-Ti, Pd-Ag and various steels. Storage of H in intermetallic compounds such as FeTiHx or LaNi5Hx was of great interest because of their importance as energy converters. Author (GRA)

N78-14148# Nottingham Univ. (England). Dept. of Metallurgy.
METALLURGICAL CHANGES IN THE HIGH TEMPERATURE FRETTING OF Ni AND Ti ALLOYS Annual Report
R. B. Waterhouse Oct. 1977 14 p
(Contracts DAJA37-75-C-2216; DAJA37-75-R-0649)
(AD-A046002; Rept-2) Avail: NTIS HC A02/MF A01 CSCL 11/6

Ti-6Al-4V specimens subjected to fretting fatigue at 400 C have been examined in SEM. Layer formation similar to that obtained on specimens tested at 200 and 600 C was observed. Fatigue and fretting fatigue curves have been determined on Inconel 718 at 20, 280, and 540 C, together with isolated observations at 700 C where creep becomes excessive. Raising the temperature has little effect on fatigue strength but improves the fretting fatigue strength. The improvement is thought to be due to glaze formation. Author (GRA)

N78-14149# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SUPERPLASTICITY OF METALS AND ALLOYS
Zbigniew Misiolek and Jerzy Turon 10 Mar. 1977 27 p refs Transl. into ENGLISH from Rudy Metale Niezelaz. (Poland), v. 16, no. 12, 1971 p 587-591
(AD-A045922; FTD-ID(RS)I-0048-77) Avail: NTIS HC A03/MF A01 CSCL 11/6

Taking into consideration the intended development and modernization of the country's manufacture of zinc, and particularly of the rolled products and considering the appearance, experimentally confirmed by the Institute of Nonferrous Metals, of the superplasticity phenomenon in zinc-aluminum alloys, as well as technical and economical benefits from using this phenomenon in technological processes, resulting from the investigations, abroad; research continues in the scope of establishing parameters of the technological process of the production and further working of semi-finished products from the above named alloys.
Author (GRA)

N78-14150# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
BRAKE-PLATES FOR AEROPLANES
Dong Sheng Lee 31 May 1977 8 p Transl. into ENGLISH from Hang Kung Chih Shih (Peking), no. 4, 1976 p 8
(AD-A045932; FTD-ID(RS)T-0819-77) Avail: NTIS HC A02/MF A01 CSCL 01/3

Brake-plates made from asbestos-plastics material in the past do not meet the needs of the modern high performance airplanes. They are replaced by brake-plates made by means of powder metallurgy and other methods that guarantee excellent heat-resistance, durability, operational stability and reliability. This paper discusses a type of brake-plates made by means of powder metallurgy.
GRA

N78-14151# Atomic Energy Research Establishment, Harwell (England). Metallurgy Div.
MASSIVE PARTICLE FORMATION IN A TYPE 316 STAINLESS STEEL DURING CREEP
D. G. Morris and D. R. Harries Oct. 1976 13 p refs
(AERE-M-2842) Avail: NTIS (US Sales Only) HC A02/MF A01; ERDA Depository Libraries

Extremely large grain boundary particles were previously observed in type 316 steel after creeping for short times at 625 C. These features were identified as consisting of numerous plates of M23C6 carbides precipitated on partial dislocations and stacking faults emitted from high-angle grain boundaries. No wholesale phase transformation to produce large intermetallic particles occurs in longer term tests, and the large particles do not appear to weaken the boundaries and cause cracking.
ERA

N78-14152# Stanford Univ., Calif. Dept. of Materials Science and Engineering.
SUBGRAIN REFINEMENT STRENGTHENING Quarterly Progress Report, 1 Apr. - 30 Jun. 1976
Rodney Klundt, Charles Schmidt, and Oleg D. Sherby 1976 24 p refs
(Contract EY-76-S-03-0326-038)
(SU-326P38X7; QPR-7) Avail: NTIS HC A02/MF A01

Substructures of ferritic HT-9 and EM-12 stainless steel alloys were studied using electron microscopy. Heat treatment changes were analyzed and torsion samples tested at 400 C, 550 C, and 700 C at a constant effective uniaxial strain rate of .006 1/s were examined. Compression creep behavior was investigated and preliminary correlations between the stress exponent at constant structure N, and applied stress were obtained. Initial test results indicate that the value of N depends on the type of test conducted such that N is larger for the tests where the strain rate is increased than for the tests where the strain rate is decreased.
ERA

N78-14153# Kraftwerk Union A.G., Mulheim (West Germany).
LONG TERM CORROSION TESTS WITH AND WITHOUT MECHANICAL STRESS ON HIGH TEMPERATURE RESISTANT ALLOYS FOR THE BLADES OF FIXED HIGH PERFORMANCE GAS TURBINES European Concerted Action. Cost 50 - Material for Gas Turbines Final Report, 1 Aug. 1973 - 31 Jul. 1976 [LANGZEIT-KORROSIONSVERSUCHE MIT UND OHNE MECHANISCHE BEANSPRUCHUNG AN HOCHWARMFESTEN LEGIERUNGEN FUER DIE SCHAUFELN VON ORTSFESTEN GASTURBINEN GROSSER LEISTUNG]
Friedhelm Schmitz 8 Sep. 1976 134 p refs In GERMAN Sponsored by Bundesmin. fuer Forsch. u. Technol.
(KWU-TWA-62482) Avail: NTIS HC A07/MF A01

Nickel and cobalt base alloys for possible application in high power gas turbine blades were investigated during laboratory corrosion tests with and without simultaneous mechanical loading. Short survey tests of 500 h duration at 700 C, 750 C, 800 C, and 850 C showed that a clear distinction can be made between materials at 750 C. Tests lasting over 4000 h showed a strong influence of chromium content on high temperature corrosion resistance of the nickel and cobalt base alloys. The Ni-alloy IN 939 (25% Cr) and the Co-alloy FSX 414 (30% Cr) proved to have highest stability.
ESA

N78-14154# Brown, Boveri & Cie Aktiengesellschaft, Baden (Switzerland). Abt. ZLM.
BEHAVIOR OF NICKEL-, COBALT-, AND IRON-ALLOYS AS A FUNCTION OF CHROMIUM CONTENT AT HIGHER TEMPERATURE European Concerted Action. Cost 50 - Materials for Gas Turbines. Final Report [VERHALTEN VON NICKEL-, COBALT- UND EISEN-LEGIERUNGEN IN FUNKTION DES CHROMGEHALTES BEI HOHER TEMPERATUR]
G. Faber and C. Maggi 1 Oct. 1976 20 p In GERMAN Sponsored by Schweiz. Eidgenoess. Volkswirtschaftsdept.
Avail: NTIS HC A02/MF A01

Alloys of Ni, Co, and Fe were molten in vacuum with increasing Cr content and tested with regard to brittleness, elongation behavior, and corrosion resistance. The results were used in corrosion testing of protective Ni-Cr and Co-Cr coatings produced by means of an existing technique used for iron-chromium alloys. It was found that nickel and cobalt base alloys are less suitable for protective coatings than iron base alloys. For nickel, as compared to iron, the lower diffusion velocity interferes and, for cobalt, the highly brittle intermetallic compounds formed with chromium.
ESA

N78-14155# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
FORMABILITY. RELATION BETWEEN WORKHARDENING, ANISOTROPY AND FORMING LIMIT DIAGRAM. PART A: TEXT
F. Hospers Feb. 1977 53 p refs Sponsored by Roy. Soc. of Gt. Brit. 2 Vol.
(VTH-LT-242A) Avail: NTIS HC A04/MF A01

Some basic questions related to formability of sheet metal are dealt with. Definitions of formability and methods of measuring formability are given. The analysis of stress-strain relations and plastic instability is outlined. Two aspects of plastic behavior under uniaxial loading are discussed: work hardening exponent and the anisotropy values are reviewed. The influence of coldworking and annealing is discussed. Results of experiments are analyzed. Plastic behavior under biaxial loading is examined. An experimental procedure for the determination of forming limit diagrams is described. The question of a failure criterion is very important in this respect. Forming limit diagrams are determined; the results are analyzed and discussed. The plastic behavior under uniaxial and biaxial loading is compared and analyzed. Some suggestions for further research are presented. Three materials were used in the experiment: commercially pure aluminum and two aluminum alloys.
Author (ESA)

N78-14156# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
FORMABILITY. RELATION BETWEEN WORKHARDENING, ANISOTROPY AND FORMING LIMIT DIAGRAM. PART B: TABLES AND GRAPHS
F. Hospers Feb. 1977 64 p Sponsored by Roy. Soc. of Gt. Brit. 2 Vol.
(VTH-LR-242B) Avail: NTIS HC A04/MF A01

Tables and graphs related to a study on formability of sheet metal are presented. The materials considered are pure aluminum and two aluminum alloys.
ESA

N78-14157# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.

EFFECT OF A REDUCED DUCTILITY AT LOW TEMPERATURES ON FATIGUE CRACK GROWTH IN 7075-T6 SHEET MATERIAL TESTED IN VACUUM

E. P. Louwaard Jan. 1977 58 p refs

(VTH-LR-243) Avail: NTIS HC A04/MF A01

Fatigue crack propagation in two types of 7075-T6 clad material was studied in air at 20 C and in vacuum at 20 C, -50 C, and -100 C, supplemented by crack closure measurements and fractographic observations. Crack growth rates in vacuum were lower than in air. One 7075 alloy (fine grained) showed similar crack rates in vacuum at 20 C and -100 C at low delta K values. The behavior of the second 7075 alloy (coarse grained) was exceptional in several ways which had to be attributed to extensive slip band cracking. Both materials showed secondary cracks perpendicular to the crack front if tested at low temperatures and sufficiently high delta K values. The secondary cracks caused a macroscopic retransition from a shear mode failure to a tensile mode failure. Practical significance of the results for fail-safe properties at low temperatures is indicated.

Author (ESA)

N78-14158# Royal Aircraft Establishment, Farnborough (England). Structures Dept.

EFFECTS OF HEAT ON FATIGUE IN AIRCRAFT STRUCTURE

J. R. Heath-Smith and F. E. Kiddle London Aeron. Res. Council 1977 35 p refs Presented at the 8th ICAF Symp. on Probl. with Fatigue in Aircraft, Lausanne, Switz., 2-4 Jun. 1975 Supersedes RAE-TR-75131; ARC-36724

(ARC-R/M-3798; RAE-TR-75131; ARC-36724) Avail: NTIS HC A03/MF A01; HMSO £14; PHI $15.30

The understanding in the UK of the effects of kinetic heating on fatigue in aluminum alloy aircraft structure is reviewed. How heating can affect subsequent fatigue at ambient temperature by softening strain-hardened material and redistributing local stress by creep is described. Also discussed is the effect on structural joints of the relaxation of clamping pressure and interference fit, and the curing of interfay compound. Tests on structural elements are described which show that, under representative load-temperature sequences with a maximum temperature of 100 C, effects on life can range between reduction and improvement by a factor of 2, depending on circumstances. Author (ESA)

N78-14159# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.

SOME FACTORS INFLUENCING THE TRANSITION FROM TENSILE MODE TO SHEAR MODE UNDER CYCLIC LOADING

L. B. Vogelesang Aug. 1976 43 p refs

(VTH-LR-222) Avail: NTIS HC A03/MF A01

Fatigue crack propagation tests in different environments were conducted using aluminum 7075-T6 and 2024-T3 sheets of different thicknesses. Observations were made on the transition from the tensile mode to the shear mode on the fracture surface. It is shown that there is no unique physical correlation between the state of stress and the mode of cracking. Besides the state of stress, the environment has a significant effect on the mode of cracking. The implications for crack growth under corrosion fatigue conditions and the fatigue mechanism are discussed.

Author (ESA)

N78-14160# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Abt. Korrosion.

STRESS CORROSION AND REPASSIVATION BEHAVIOR OF AUSTENITIC STAINLESS STEELS IN BOILING $MgCl_2$ SOLUTION

Horst Buhl and Paul Kuhn 16 May 1977 58 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-437)

(DLR-FB-77-19) Avail: NTIS HC A04/MF A01; DFVLR, Cologne DM 29,30

The stress corrosion susceptibility of the two austenitic stainless steels X 5 CrNi 18 9 (material no. 1.4301) and X 10 CrNiMbTi 18 10 (1.4571) was investigated in boiling $MgCl_2$ solution using the constant strain rate test method. The investigations were completed by repassivation measurements in the same environment. Test results show the susceptibility of both materials to SCC. The critical potentials were found at -150 nV sub H for the 1.4301 material, and -140 mV sub H for 1.4571. This means full agreement with the results of conventional constant load tests. Information on the incubation period received from the number of cracks agrees with the results of other investigations in this range. The crack growth velocity seems to show a maximum at a characteristic strain rate. The repassivation investigations show an increasing repassivation time starting at the critical potentials in the direction of more positive polarization. This confirms the relation between SCC and repassivation. The formation velocity of the first compact passive layer and the growth rate of this passive layer are faster at the molybdenum containing steel 1.4571 than the molybdenum-free steel 1.4301. Author (ESA)

N78-14161# American Electroplaters Society, Inc. Winter Park, Fla.

REVERSE OSMOSIS FIELD TEST: TREATMENT OF COPPER CYANIDE RINSE WATERS Final Report

Kenneth J. McNulty, Robert L. Goldsmith, Arye Gollan, Sohrab Hossain, and Donald Grant Aug. 1977 102 p refs Prepared in cooperation with Abcor, Inc., Wilmington, Mass.

(Grant EPA-R-i00945)

(PB-272473/0; EPA-600/2-77-170) Avail: NTIS HC A06/MF A01 CSCL 11F

Field tests of reverse osmosis (RO) were conducted on copper cyanide rinse waters at two different sites: Whyco Chromium Co. and New England Plating Co. At both sites, closed-loop treatment was used with plating chemicals recycled to the bath and purified water recycled to the rinsing operation. It was concluded that RO can be used to close the loop in copper cyanide plating. However, care must be taken to insure that adequate membrane life can be achieved. Where membrane life approaches that in traditional RO applications, the capital and operating costs for RO, compared to those for alternative treatment processes, are attractive. GRA

N78-14993# European Space Agency, Paris (France).

EXPERIMENTAL EVIDENCE OF TWO STRESS CORROSION MECHANISMS IN AN Al-Zn-Mg-Cu ALLOY

C. Renon and H. Martinod *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-3 (ESA-TT415) Sep. 1977 p 97-124 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-3, May-Jun. 1977 p 179-190 Original report in FRENCH previously announced as A77-38745 (For availability see N78-14988 05-99)

Avail: NTIS HC A08/MF A01

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N78-14162 British Library Lending Div., Boston Spa (England).

APPLICATION OF DIFFERENT TYPES OF QUARTZ GLASS IN LIGHT SOURCES

T. A. Shchetinina Oct. 1977 7 p refs Transl. into ENGLISH from Svetotekhnika (USSR), v. 1, 1977 p 21-22

(BLL-RTS-10967) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

Quartz glass tubes used in gas discharge lamps, metal halide lamps, and halide filament lamps are discussed. Physico-chemical properties and quality required for each type of light source are considered along with the method of production.

J.M.S.

N78-14163 British Library Lending Div., Boston Spa (England).

NATURAL ANTIOXIDANTS IN MINERAL OILS

P. Studt Jun. 1977 7 p refs Transl. into ENGLISH from Compendium, Deut. Ges. fuer Mineraloel-Wiss. und Kohlechem. (West Germ.), no. 2, 1976/77 p 881-885

(BLL-RTS-10770) Avail: British Library Lending Div., Boston

Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

The nature of agents which tend to stabilize mineral oils against attack by atmospheric oxygen was investigated. Aromatic hydrocarbons together with sulfur compounds were found to be responsible for inhibiting oxidation. This synergistic effect was studied and found to be attributable to the synergy of sulfur compounds with phenols formed from the aromatics in the course of autoxidation. B.L.P.

N78-14164* National Aeronautics and Space Administration. Pasadena Office, Calif.

DURABLE ANTISTATIC COATING FOR POLYMETHYLMETHACRYLATE Patent

Vaclav Hadek (JPL), Robert B. Somoano (JPL), and Alan Rembaum, inventors (to NASA) (JPL) Issued 6 Dec. 1977 4 p Filed 3 Jun. 1976 Supersedes N77-22257 (15 - 13, p 1699) Sponsored by NASA

(NASA-Case-NPO-13867-1; US-Patent-4,061,834; US-Patent-Appl-SN-692284; US-Patent-Class-428-522; US-Patent-Class-428-922; US-Patent-Class-428-411; US-Patent-Class-96-87A; US-Patent-Class-260-DIG.15; US-Patent-Class-427-164) Avail: US Patent Office CSCL 11G

A durable antistatic coating is achieved on polymethylmethacrylate plastic without affecting its optical clarity by applying to the surface of the plastic a low molecular weight solvent having a high electron affinity and a high dipole moment, such as acentonitrile or nitromethane alone or in the presence of photopolymerizable monomer. The treated polymethylmethacrylate plastic dissipates most of the induced electrostatic charge and retains its optical clarity. The antistatic behavior persists after washing, rubbing and vacuum treatment.

Official Gazette of the U.S. Patent Office

N78-14165 British Library Lending Div., Boston Spa (England).

PROTONS IN GLASSES: NUCLEAR MAGNETIC RESONANCE AND INFRA-RED SPECTROSCOPIC INVESTIGATIONS OF THE STRUCTURE OF GLASSES AND THEIR WATER CONTENT

W. Muller-Warmuth, G. W. Schulz, N. Neuroth, F. Meyer, and E. Deeg 17 Nov. 1965 21 p refs Transl. into ENGLISH from Z. Naturforschg. 20a (West Ger.), 1965 p 902-917 (BLLD-M-24904-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

Nuclear magnetic H and Si resonance investigations and the changes in the OH- infrared spectrum were used to obtain information about the inclusion of protons in glasses and the short range order of binary alkali silicate glasses. The line structure of the proton resonance was explained by the magnetic dipole interaction with Li, Na, K, Ca or the nuclear moments of Si, B, Al and Pb. The fine structure in alkali silicate glasses was not materially alerted if Li+ was replaced by Na+ or Ca+. However, there was an increasing tendency for the uptake of hydrogen as H+ ions into the network. These were bound to O- ions which appeared at interstices produced by alkali ions. The resultant magnetic resonance was compatible with a model in which two ions, respectively an alkali ion and a hydrogen ion, always appeared as pairs with a separation of 2A. Author

N78-14166 Minnesota Univ., Minneapolis.

FREE-MOLECULE FLOW IN POROUS GLASS Ph.D. Thesis

Anthony Lee Wright 1977 332 p

Avail: Univ. Microfilms Order No. 77-19053

The results are presented of an experimental examination of the effect of the gas-wall interaction on the free-molecule flow of gases through Vycor porous glass. Inert gases helium and argon and adsorbable gases ethane, carbon dioxide, and pentane were used. Diffusion coefficients and flows were measured as a function of mean pressure from T = 304 K to T = 313 K. Experimental free-molecule flows differ significantly from those predicted when the gas-surface interaction is ignored. Differences between pentane isomers were significant. The Vycor sample was then used to separate two isomers of pentane that were initially at the same partial pressure. The pressure difference resulting from the inter-diffusion of pentane isomers could be predicted reasonably well. Several models are proposed to account for the observed gas and temperature dependence of free-molecule flow and model parameters calculated for the gases studied. Dissert. Abstr.

N78-14167 Michigan Univ., Ann Arbor.

ESTEROLYTIC ACTIVITY OF WATER SOLUBLE, HYDROPHOBIC TERPOLYMERS OF 4(5)-VINYLIMIDAZOLE Ph.D. Thesis

Arthur Christian Guterl, Jr. 1977 113 p

Avail: Univ. Microfilms Order No. 77-18013

Water soluble terpolymers with varied hydrophobic side chains were prepared under controlled conditions and tested for effectiveness as nucleophilic polymers in the hydrolyses of hydrophobic ester substrates. Terpolymers of 4(5)-vinyl-imidazole, acrylamide and either 3-buten-2-one, 1-penten-3-one, 1-undecen-3-one, or 1-hexadecen-3-one were synthesized. The esterolyses of 3-nitro-4-acyloxybenzoic acid substrates with 2,7,12 and 18 carbons were examined in water and 30 volume per cent ethanol-water solutions. The terpolymers with the apolar side chains revealed high catalytic activity. The data also revealed the effectiveness of the terpolymer side chains. In addition, the presence of apolar hydrocarbon in fewer but longer terpolymer side chains was demonstrated to be superior to a similar amount of apolar hydrocarbon present in a larger number of shorter chain monomers. Kinetic determinations were carried out under conditions of excess catalyst and were second order.

Dissert. Abstr.

N78-14168 Case Western Reserve Univ., Cleveland, Ohio.

MICRODEFORMATION IN AMORPHOUS POLYMERS Ph.D. Thesis

Stephen Thomas Wellinghoff 1977 165 p

Avail: Univ. Microfilms Order No. 77-18851

The craze initiation and growth process in thin films of polystyrene were studied via electron microscope techniques. Inhomogeneity in the surface microstructure gave rise to the formation of ca. 300A nuclei in which large strains were localized. These randomly distributed nuclei were even formed at the glass transition temperature in the presence of bulk shear deformation. A disk shaped microneck zone was ultimately formed by coalescence of these nuclei which were followed by cavitation and fibrillation of this zone at a critical internal hydrostatic tension. Cavity and fibril stability increased with molecular weight above the entanglement molecular weight. Although the microneck zone formed in the lowest molecular weight sample (10,000 M.W.) bifurcated by rapid crack growth, the addition of only small weight percentage of a high molecular weight component (0.2% 670,000 M.W.) induced cavitation and fibrillation. Dissert. Abstr.

N78-14169 British Library Lending Div., Boston Spa (England).

THERMOSETTING PLASTICS THEIR RHEOLOGICAL PROPERTIES AND THE EFFECT OF PRODUCTION PARAMETERS ON MECHANICAL PROPERTIES

M. Gajewski Jun. 1977 12 p refs Transl. into ENGLISH from Polimery (Warsaw), v. 21, no. 6, 1976 p 272-275 (BLL-RTS-10703) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

The effectiveness of a method for roughly assessing the use of various plastic materials for injection molding by comparing fluidity and curing time was evaluated. Tolerances in the parameters of melamine and phenol plastics were determined. A study of the variation in the mechanical properties related to the injection parameters yielded the optimum process ranges. Materials produced in Poland had similar characteristics with important materials; however, their lower thermal resistance requires a longer curing time. A.R.H.

N78-14170 Stanford Univ., Calif.

DIELECTRIC RELAXATION IN POLYMERS AT LOW TEMPERATURES Ph.D. Thesis

Richard Alan Thomas 1977 99 p

Avail: Univ. Microfilms Order No. 77-18257

The dielectric loss tangent of a number of solids was measured calorimetrically at liquid helium temperatures and over the audio frequency range to gain a better understanding of the dielectric relaxation mechanisms which give rise to dielectric loss at low temperatures and to examine and test insulating materials that are possible candidates for use in the construction of a

superconducting ac power transmission line. The apparatus used is capable of measuring calorimetrically loss tangents as small as 0.6 microradian with a resolution of ten percent of the value at voltages up to ten kilovolts. The conditions necessary to obtain polyethylene exhibiting an intrinsically low dielectric loss tangent of only about five microradians were determined. Dissert. Abstr.

N78-14171 Michigan Univ., Ann Arbor.
THEORY OF SMALL ANGLE NEUTRON SCATTERING IN POLYMER PHYSICS Ph.D. Thesis
Salim Najib Jahshan 1977 124 p
Avail: Univ. Microfilms Order No. 77-18033

Small angle neutron scattering was applied to the study of several polymer systems. The theoretical development for obtaining the form and contrast factors for the study was reviewed. Form factors for several models of single morphologies of quasicrystalline polymers were derived and comparisons were made of the models. A flexible model to accommodate the random reentry arguments as well as the adjacent folding chain arguments was proposed. An examination was made of scattering from partially crystallized bulk chains. The form factor of single chains in dilute solutions with excluded volume effect was calculated. Dissert. Abstr.

N78-14172# Washington Univ., Seattle. Dept. of Mining Metallurgical and Ceramic Engineering.
STRENGTH OF LONG GLASS FIBERS Final Report, 2 Dec. 1974 - 29 Feb. 1976
William D. Scott, A. Gaddipatti, and Gordon L. Mitchell 1 Sep. 1977 40 p refs
(Contract N00123-73-C-1200)
(AD-A046013) Avail: NTIS HC A03/MF A01 CSCL 11/2

Long silica fibers were drawn and coated in-line with polyethylene. The strength of specimens from 0.05 to 11.96 meters was measured, and the strength distribution of 119 specimens, 1.06 meters long, was also measured. Three methods of estimating the parameters of the Weibull statistical distribution are compared, and the influence of bimodal populations on the shape of an assumed Weibull distribution is demonstrated and applied to the test sample of 119 silica fibers.
Author (GRA)

N78-14173# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EPOXY AND POLYURETHANE PAINT COMPOSITIONS FOR AGRICULTURAL AIRPLANES
Wojciech Poninski 16 Mar. 1977 28 p refs Transl. into ENGLISH from Prace Inst. Lotnictwa (Poland), no. 62, 1975 p 81-93
(AD-A045914; FTD-ID(RS)I-0198-77) Avail: NTIS HC A03/MF A01 CSCL 11/9

In the article there has been presented the progress in paint materials used for agricultural airplanes that has been attained in this country in the course of twenty years. In connection with the development in the world of polyurethane paint materials there have been carried through comparative investigations of the epoxy compositions currently being used with three different polyurethane compositions. There has been described the methodology of the tests which included also investigations of selected materials for protecting plants (insecticides etc.), as also under conditions that imitated the atmospheric influences. The results achieved point to the better properties of the polyurethane compositions in comparison with the epoxy ones, equally also in the presence the action of atmospheric factors as also the action of means of protecting plants (insecticides etc.).
Author (GRA)

N78-14174# State Univ. of New York, Stony Brook. Dept. of Materials Sciences.
PROPERTIES OF MATERIALS QUENCHED FROM THE LIQUID STATE Final Report, 1 Feb. 1970 - 30 Jun. 1976
Herbert Herman 1 Sep. 1977 35 p refs
(Grants DA-ARO(D)-31-124-70-G32; DAHC04-75-G-0199)
(AD-A046246; ARO-8571.11-MC) Avail: NTIS HC A03/MF A01 CSCL 11/6

Metal alloys and refractory oxides have been quenched (splat cooled) from the liquid state at ultra-high rates using a wide range of techniques. The alloys have been quenched by the standard shock-tube method, while oxides were quenched using laser methods or with plasma spraying. The rapid quench permits access into metastable regions of the phase diagram, thus yield ultra-high supersaturation. The earliest regime of precipitation reactions are able to be detected, and, thus, a linear spinodal process has been determined in several alloys. Liquid quenching is useful for studies of phase transformation, since the system can be obtained in highly metastable states. Small-angle X-ray and neutron scattering and transmission electron microscopy were used in this study. Author (GRA)

N78-14175# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
STUDY OF THE PROPERTIES OF LOW TEMPERATURE PIEZOELECTRIC CERAMICS FOR USE IN GRAVITATIONAL ANTENNAS [STUDIO DELLE PROPRIETA DI UNA CERAMICA PIEZOELETTRICA A BASSE TEMPERATURE PER IMPIEGO NELLE ANTENNE GRAVITAZIONALI]
V. Iafolla Feb. 1977 58 p refs In ITALIAN
(LPS-77-5) Avail: NTIS HC A04/MF A01

Electrical and mechanical properties of the piezoelectric ceramics Pb(Ti, Zr)O3 were measured at temperatures between 300 and 1.2 K. The study is part of a gravitational wave project and its aim was to optimize the functioning of the Rome gravitational wave antenna. The Q sub M temperature curve shows a peak around 277 K when the Q sub M (merit factor) value is 600. Between 70 and 1.2 K the curve rises again, with maximum Q sub M value around 500. It is concluded that piezoelectric Pb(Zr, Ti)O3 cannot be used as resonator and as transducer at the same time. ESA

N78-14176# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Reactor Physics.
PENETRATION OF A ROT-PROOFING AGENT INTO WOOD INVESTIGATED BY MEANS OF NEUTRON ACTIVATION ANALYSIS
Stefano Hirschberg and Gudmar Grosshoeg May 1977 21 p refs In SWEDISH; ENGLISH summary
(CTH-RF-29) Avail: NTIS HC A02/MF A01

The average depth of penetration for an impregnating liquor into a test bar of wood was found to be 1.4 plus or minus 0.2 mm. The measurement was made by means of a neutron activation analysis, with chlorine and tin as indicator substances. Two reactions were used, one for chlorine and one for tin. The gamma energies and half-lifes are too close to separate the reactions with the present instrumentation. The irradiation was performed with 14 MeV neutrons from a 150 keV generator. Author (ESA)

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N78-14177*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE AND EMISSIONS OF A CATALYTIC REACTOR WITH PROPANE, DIESEL, AND JET A FUELS
David N. Anderson Sep. 1977 26 p refs Presented at the Fall Meeting, Western States Section of the Combust. Inst., Stanford, Calif., 17-18 Oct. 1977
(Contract EC-77-A-31-1011)
(NASA-TM-73786; CONS/1011-20; E-9349) Avail: NTIS HC A03/MF A01 CSCL 21D

Tests were made to determine the performance and emissions of a catalytic reactor operated with propane, No. 2 diesel, and Jet A fuels. A 12-cm diameter and 16-cm long catalytic reactor using a proprietary noble metal catalyst was operated at an inlet temperature of 800 K, a pressure of 300,000 Pa and reference velocities of 10 to 15 m/s. No significant differences between the performance of the three fuels were observed when 98.5 percent purity propane was used. The combustion efficiency for 99.8-percent purity propane tested later was significantly lower, however. The diesel fuel contained 135 ppm of bound nitrogen and consequently produced the highest NOx emissions

of the three fuels. As much as 85 percent of the bound nitrogen was converted to NOx. Steady-state emissions goals based on half the most stringent proposed automotive standards were met when the reactor was operated at an adiabatic combustion temperature higher than 1350 K with all fuels except the 99.8-percent purity propane. With that fuel, a minimum temperature of 1480 K was required. Author

N78-14178# National Aviation Facilities Experimental Center, Atlantic City, N. J.
EXPERIMENTAL SCALING OF MODIFIED FUEL BREAKUP Interim Report, Jul. 1975 - Nov. 1976
Thor I. Eklund Aug. 1977 27 p refs
(AD-A045228/4; FAA-NA-77-34; FAA-RD-77-114) Avail: NTIS HC A03/MF A01 CSCL 21/4

A small-scale test configuration was developed for modified fuel breakup and ignition testing. The configuration consisted of a 1/4-inch fuel delivery tube within a 1-inch air atomization pipe followed by a deceleration cone. Photographic evaluation required design of a unique fuel spray photographic chamber which has the capability of photomicrographic, schlieren, and stroboscopic photographic techniques. The chamber employs positive pressurization with diluent air to prevent spray recirculation and fuel deposition on optical components. The spark photographs proved that the breakup phenomenon can be scaled down without obliteration of the dominant rheological effects. Motion pictures of ignition show the same flammability behavior shown in larger scale tests. It is concluded the the concentric tube atomization technique provides a practical method for comparative evaluation of modified fuels on a small scale. Author

N78-14179# Bell Aerospace Co., Buffalo, N. Y.
ANALYSIS OF PROPELLANT STORAGE TANKS AFTER FOUR YEARS HYDRAZINE STORAGE Final Report, May 1976 - Apr. 1977
E. J. King and H. G. Kammerer May 1977 119 p refs
(Contract F04700-76-90043)
(AD-A046204; AFRPL-TR-77-25) Avail: NTIS HC A06/MF A01 CSCL 13/4

This report covers the examination and metallurgical evaluation of four tanks after they had been subjected to over four years storage with hydrazine propellant. The tank materials included 17-7 PH stainless steel and AM350, also a precipitation hardened stainless steel. Only one instance of serious corrosion was found in the tanks and that was found to be most likely caused by an external source in the over one year time elapsed between removal of the tanks from hydrazine storage, and the start of evaluation. The hydrazine storage occurred in two periods, the first of which was one year during the temperature control was a problem (nominal 83.3 F). During this time some hydrazine decomposition did occur and venting was required to relieve pressure buildup. After modification and improvement of the insulation and temperature control equipment in the building, a temperature of 120 F was held steadily for the 3-1/3 years of remaining storage time, with no further pressure rise or hydrazine decomposition. GRA

N78-14180# Mobil Research and Development Corp., Paulsboro, N. J.
DEVELOPMENT STUDIES ON CONVERSION OF METHANOL AND RELATED OXYGENATES TO GASOLINE Final Report
S. E. Voltz and J. J. Wise Nov. 1976 340 p refs
(Contract EX-76-C-01-1773)
(FE-1773-25) Avail: NTIS HC A15/MF A01

A novel process for the conversion of methanol to high octane gasoline has been successfully demonstrated. Both fixed and fluid bed process concepts have been pursued. Two reactors are used in the fixed bed process. Methanol is partially dehydrated to an equilibrium mixture of methanol, dimethylether, and water over a dehydration catalyst in the first reactor, and both methanol and dimethylether are converted to high octane gasoline by a catalyst in the second reactor. Over 200 days of successful operation were achieved during nine cycles in a fixed bed pilot plat. About 8000 lb methanol/lb conversion catalyst were processed, and catalyst performance was still satisfactory when the aging test was terminated. The dehydration catalyst did not require any regeneration during the entire aging test. A single reactor is used in the fluid bed process. The feasibility of converting methanol to gasoline in a fluid bed was demonstrated during an aging test of two months duration. ERA

N78-14181# Oak Ridge National Lab., Tenn.
ENERGY SOURCES OF POLYCYCLIC AROMATIC HYDROCARBONS
M. R. Guerin 1977 77 p refs Presented at Conf. on Polycyclic Hydrocarbon Carcinogenesis, New Orleans, 24 Jan. 1977 Sponsored in part by EPA
(Contract W-7405-eng-26)
(Conf-770130-2) Avail: NTIS HC A05/MF A01

Combustion is the predominant end-process by which fossil fuels are converted to energy. Combustion, particularly when inefficient, is also the primary technological source of polycyclic aromatic hydrocarbons (PAHs) released into the environment. The need for liquid fuels to supply the transportation industry and for nonpolluting fuels for heat and power generation provide the incentive to commercialize processes to convert coal to substitute natural gas and oil. These processes represent a potentially massive new source of environmental PAHs. Insuring an adequate supply of energy with minimum impact on the environment and on health is one of the most important, urgent, and challenging goals currently facing science and technology. Polycyclic aromatic hydrocarbon related carcinogenesis is among the most important of possible occupational- and environmental-health impacts of much of the current and projected national energy base. ERA

N78-14182# Los Alamos Scientific Lab., N. Mex.
SYNTHETIC FUEL PRODUCTION FROM SOLID WASTES Final Report
Roy C. Feber and Michael J. Antal (Princeton Univ., N. J.) Sep. 1977 87 p refs
(Contract EPA-IAG-D5-0646)
(PB-272423/5; EPA-600/2-77-147) Avail: NTIS HC A05/MF A01 CSCL 21D

Potential catalysts for the commercial practice of the gasification of chars produced by the pyrolysis of municipal or industrial wastes are evaluated. The potential for synthetic fuel production from solid wastes and the feasibility of providing the heat required for the gasification reactions by coupling a chemical reactor to a solar collector are also examined. A small scale, fixed bed, flow through reactor was assembled, and a number of potential catalysts were tested on chars from a number of sources. Several possible schemes for coupling a solar collector and a gasification reactor are suggested, and economic analyses of the systems are attempted. It is concluded that feasible, economically attractive systems are possible. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N78-14183# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
ENGINEERING BEHAVIOR OF PAVEMENT MATERIALS: STATE OF THE ART Final Report
Yu. T. Chou Feb. 1977 414 p refs
(Contract DOT-FA73WAI-377; DA Proj. 4A7-62719-AT-04)
(AD-A045272/2; AEWES-TR-S-77-9; FAA-RD-77-37) Avail: NTIS HC A18/MF A01 CSCL 13/2

Pavement materials are evaluated with respect to highway and aircraft loadings and environmental conditions. The materials covered are bituminous mixtures, portland cement concrete, granular materials, chemically stabilized soils, and fine grained soils. Basic properties of each are discussed. For bituminous mixtures, emphasis is placed on the characteristics of permanent deformation, fatigue, and rheological properties and the application to pavement design of accumulative damage theory. For portland cement concrete, concrete strengths determined by various tests are discussed. The fatigue property of concrete and its relationship to pavement design are elaborated. For granular materials, the resilient and plastic properties are analyzed. Constitutive stress-strain relations consist of resilient, plastic,

shear, and dynamic stresses and strains. For soil stabilization, the mechanisms of stabilization are explained, which include soil-cement, soil lime, lime-fly ash, and lime-cement-fly ash and bituminous materials. Factors influencing engineering properties and properties of stabilized soils with respect to strength, modulus, and fatigue are discussed. Author

N78-14184# European Space Agency, Paris (France).
LA RECHERCHE AEROSPATIALE. BI-MONTHLY BULLETIN NO. 1976-6
Oct. 1977 109 p refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-6, Nov.-Dec. 1976 p 301-358 Original French report available from ONERA, Paris FF 30
(ESA-TT-406) Avail: NTIS HC A06/MF A01

Topics dealt with are: highly cambered blades in cascades, oscillating in a compressible gas; small unsteady perturbations of a permanent one-dimensional flow pattern; study of a supersonic annular rotating cascade; loads and acceleration in roll of aircraft flying in turbulence; finite element calculation of multilayer shells; and bending crack test for determining fatigue crack propagation laws. For individual titles, see N78-14185 through N78-14190.

N78-14185# European Space Agency, Paris (France).
HIGHLY CAMBERED BLADES IN CASCADES OSCILLATING IN A COMPRESSIBLE GAS **c34**
Robert Legendre *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1976-6 (ESA-TT-406) Oct. 1977 p 1-10 Transl into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-6, Nov.-Dec. 1976 p 301-305 Original report in FRENCH previously announced as A77-27026 (For availability see N78-14184 05-31)
Avail: NTIS HC A06/MF A01

A method is proposed for calculating a profile in a cascade on which the velocity is a given function of the potential and for determining simultaneously the potential everywhere in the plane of the cascade. The effects of oscillations of limited nature undergone by the blades are calculated in coordinates of the potential and the stream function of the mean steady flow.
Author (ESA)

N78-14186# European Space Agency, Paris (France).
SMALL UNSTEADY PERTURBATIONS OF A PERMANENT ONE-DIMENSIONAL FLOW **c34**
Pierre Carriere *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1976-6 (ESA-TT-406) Oct. 1977 p 11-41 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-6, Nov.-Dec. 1976 p 307-321 Original report in FRENCH previously announced as A77-27021 (For availability see N78-14184 05-31)
Avail: NTIS HC A06/MF A01

A basic stationary flow-pattern, one-dimensional but subject to slight unsteady perturbations in flowrate, momentum, or energy, and also fluctuations in the duct transverse section area, was investigated. The selection of dependent variables associated with acoustic and entropic propagation modes, and an independent variable acting as function of the local Mach number of the flow, were examined. Flow singularities investigated include: the sonic throat, shock waves, discontinuities in cross section, and localized suction. Some particular cases of interest are worked out. Author (ESA)

N78-14187# European Space Agency, Paris (France).
THEORETICAL AND EXPERIMENTAL STUDY OF A SUPERSONIC, ANNULAR, ROTATING CASCADE **c34**
Jacques Paulon and Jean-Pierre Veuillot *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1976-6 (ESA-TT-406) Oct. 1977 p 42-57 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-6, Nov.-Dec. 1976 p 323-331 Original report in FRENCH previously announced as A76-47376 (For availability see N78-14184 05-31)
Avail: NTIS HC A06/MF A01

A study of flow patterns through supersonic moving cascades was carried out for various assigned counterpressures, covering starting flow and mixed flow conditions. Frwon loop tests yielded pressure distributions in the vane channels that are compared with a numerical prediction based on a pseudo-nonstationary method and on the method of characteristics. A shock capturing approach was resorted to in the numerical integration of the system of flow PDE, with localization of shocks not known a priori. Boundary-layer separation (BLS) is left out of the computations though BLS was observed experimentally on blade backs, and conditions requiring a program for calculating shock-BL interaction are alluded to. Author (ESA)

N78-14188# European Space Agency, Paris (France).
MEAN NUMBER OF LOADS AND ACCELERATIONS IN ROLL OF AN AIRCRAFT FLYING IN TURBULENCE **c02**
Gabriel Coupry *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1976-6 (ESA-TT-406) Oct. 1977 p 58-69 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-6, Nov.-Dec. 1976 p 333-338 Original report in FRENCH previously announced as A76-43142 (For availability see N78-14184 05-31)
Avail: NTIS HC A06/MF A01

The effect of the spanwise distribution of isotropic turbulence on the mean number of loads and accelerations in roll of an airplane which is assumed to be perfectly rigid is dealt with. Attention is devoted to the derivation of a transverse coherence function of turbulence, associated with the usual spectra, which explains most of the discrepancies that appear in the comparison of measured and calculated transfer functions of aircraft to turbulence. The use of this transverse coherence function, associated with unsteady aerodynamic theory, makes it possible to calculate the Rice's integrals related to the mean number of loads and roll acceleration without any further assumption. Very simple approximate formulas are proposed, and comparisons of predicted and measured numbers of loads are presented for Caravelle flights. Author (ESA)

N78-14189# European Space Agency, Paris (France).
CALCULATION OF AXISYMMETRIC MULTILAYER SHELLS BY THE FINITE ELEMENT METHOD **c39**
Daniel Engrand *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1976-6 (ESA-TT-406) Oct. 1977 p 70-89 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-6, Nov.-Dec. 1976 p 339-348 Original report in FRENCH previously announced as A76-47364 (For availability see N78-14184 05-31)
Avail: NTIS HC A06/MF A01

A one-layer analysis is followed by analysis of several layers, composites, or sandwiches with various application examples. Mechanical and thermal loadings, in initial strain and strain energy calculations, and the nature of thermal constraints are discussed for one-layer and multilayer configurations, with particular sections devoted to treatment of: a statistically loaded pinned cylinder, a reinforced composite cylinder reinforced at its closures by hoops or frames, hydroelastic oscillations of a liquid-filled multilayered tank, and thermal constraints in a homogeneous ogive. Limitations of the method are indicated (poor applicability to thick-layer shell sandwiches, or to an excessive number of layers). Author (ESA)

N78-14190# European Space Agency, Paris (France).
ADVANTAGE OF THE BENDING CRACK TEST FOR DETERMINING FATIGUE CRACK PROPAGATION LAWS **c39**
Georges Baudin, Jean Lemaitre, and Michel Robert *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1976-6 (ESA-TT-406) Oct. 1977 p 90-106 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-6, Nov.-Dec. 1976 p 349-358 Original report in FRENCH previously announced as A77-27022 (For availability see N78-14184 05-31)
Avail: NTIS HC A06/MF A01

Crack energy, crack propagation, stress effects, stress history, equipment and tests used, and crack initiation and creep at elevated temperatures are discussed. The advantage of bending crack tests with a simple mechanical mounting and electronic data processing arrangement, over tensile tests, is argued. The procedure recommended is applied to: measurement of crack energy rate by the stiffness/compliance method, determination of crack propagation laws under specified loading patterns, study of loading history, and high-temperature crack tests involving coupling of fatigue and creep effects. Author (ESA)

N78-14191# Michigan Univ., Ann Arbor. Highway Safety Research Inst.
MODULAR PROGRAM DEVELOPMENT FOR VEHICLE CRASH SIMULATION. VOLUME 3, USERS GUIDE FOR UMVCS-1 Final Report, Mar. 1974 - Nov. 1976
R. O. Bennett, I. K. McIvor, D. H. Robbins, and H. C. Wang Aug. 1977 284 p refs
(Contract DOT-HS-4-00855)
(PB-272425/0; UM-HSRI-76-4-3; DOT-HS-802-532) Avail: NTIS HC A13/MF A01 CSCL 13B

An instruction and information manual is presented to enable the user to prepare an input data set for exercising the vehicle crash simulation program. The guide describes the input quantities which must be provided to the executive section of the program; it also gives a description and sample output of the executive system, a description and sample of the output produced by the computer program, and an example problem including a sample data set and exercise. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N78-14192 Rice Univ., Houston, Tex.
THE EXPERIMENTAL SATURATION SPECTRUM OF PARAMETRIC INSTABILITIES Ph.D. Thesis
Lewis Mannan Duncan, III 1977 135 p
Avail: Univ. Microfilms Order No. 77-19245

Intense high frequency electromagnetic radiation was used to excite parametric instabilities in the stable F region ionospheric plasma. The saturation spectrum of the resulting enhanced electron plasma oscillations was measured using a 430-MHz incoherent backscatter radar. Particular attention was given to the geometrical details of the wave plasma coupling interactions. The shape of the saturation spectrum was shown to strongly depend on the strength of the induced plasma line enhancement. For small enhancements, the spectrum is a diffusive cascade of energy to lower frequencies. In this case, the parametric excitation was found to be below threshold and the enhanced plasma oscillations were stabilized through a nonresonant mode coupling. For greater plasma line enhancements, distinct spectral features appear in association with the formation of satellite plasma waves. These results are in agreement with the theory that nonlinear Landau damping by ions becomes the dominant saturation mechanism above instability threshold. Dissert. Abstr.

N78-14193 British Library Lending Div., Boston Spa (England).
HIGH QUALITY TRANSHORIZON RADIO LINKS
L. Boithias and J. Battesti Apr. 1977 28 p refs Transl. into ENGLISH from Ann. Telecommunications (Seine), v. 20, no. 718, Jul./Aug. 1965 p 138-150
(BLL-PO-3398-(9022.81)) Avail: British Library Lending Div., Boston Spa, Engl.

Information, based on the most recent experimental studies and results, essential for the realization of a transhorizon radio transmission network conforming in quality to CCIR recommendations is presented. Propagation curves are given for various climates and various time percentages, either for the whole year (interference study) or for the least favorable months (study of transmission quality). The essential characteristics of transhorizon radio link equipment are indicated. Author

N78-14194 Rice Univ., Houston, Tex.
TRI-STATE DELTA MODULATION (TSDM) FOR VIDEO ENCODING Ph.D. Thesis
George Clifford Collins 1977 226 p
Avail: Univ. Microfilms Order No. 77-19239

An adaptive three level delta modulation scheme, particularly suited for inframe picture encoding, was studied. This modulation scheme, called tri-state delta modulation (TSDM) is described as an extension of an adaptive delta modulator (ADM), in which the hard limitter of the ADM system is replaced by a hard limitter with a dead zone on the region (-xi, xi). Digital simulation results show the validity of such a scheme. Dissert. Abstr.

N78-14195 State Univ. of New York at Buffalo, Amherst.
AN EFFECTIVE PROCEDURE FOR SIGNAL REPRESENTATION Ph.D. Thesis
Tzeng-Tung Thomas Hwang 1977 163 p
Avail: Univ. Microfilms Order No. 77-19446

A procedure for discrete-time signal modeling and identification is presented and applied to the design of two-dimensional linear recursive digital filters. Frequently, a signal to be matched is not so readily representable as the unit-sample response of a linear recursive system. To properly handle such signals, the signal to be modeled is first orthogonally transformed by an appropriately chosen preprocessing operator. By using this approach practical one-dimensional and two-dimensional signal modeling problems can be satisfactorily handled. Thus, a more general class of signals can be represented as the unit-sample response of a lower order model. A set of computer programs was written and a complete set of FORTRAN listings is presented. Dissert. Abstr.

N78-14196 Carnegie-Mellon Univ., Pittsburgh, Pa.
LITHIUM NIOBATE OPTICAL WAVEGUIDES AND WIDEBAND ACOUSTO-OPTIC BRAGG DIFFRACTION USING MULTIPLE TILTED SURFACE ACOUSTIC WAVES Ph.D. Thesis
Mohammed A. Alhaider 1977 232 p
Avail: Univ. Microfilms Order No. 77-19187

Thin film waveguides were fabricated on LiNbO3 crystals by a modified outdiffusion technique. This method was found capable of creating a high quality waveguiding layer. The waveguides fabricated by this method exhibited good beam quality and a throughput coupling efficiency was as high as 40%. These waveguides combine qualities such as ease of fabrication, confinement to a thin layer, and the possibility for mode conversion between TE and TM modes. The analysis, design fabrication, and measurement of wideband guided-wave acousto-optic deflectors using LiNbO3 optical waveguides are discussed. Experimental results using tilted SAW's in single model Y-cut LiNbO3 outdiffused waveguides are presented. Dissert. Abstr.

N78-14197 Arizona Univ., Tucson.
EXCITATION OF A PARAMETRIC DECAY INSTABILITY BY AN ELECTROMAGNETIC WAVE AT TWICE THE UPPER HYBRID FREQUENCY Ph.D. Thesis
Robert Benjamin Piejak 1977 92 p
Avail: Univ. Microfilms Order No. 77-18661

A fluid theory is presented which describes the parametric instability of a pair of electrostatic waves by a large amplitude electromagnetic wave propagating along a d.c. magnetic field in a warm homogeneous plasma. It is assumed that the decay waves oscillate at a frequency near the plasma frequency, and that the electromagnetic pump wave oscillates at twice the plasma frequency. The threshold voltage of the pump wave, necessary to excite the instability, and the growth rate of the decay wave pair are found. Dissert. Abstr.

N78-14198 Arizona Univ., Tucson.
GEOMETRICAL REPRESENTATIONS OF THE TRANSVERSE GOOS-HAENCHEN SHIFT FOR CYLINDRICAL DIELECTRIC WAVEGUIDE MODES Ph.D. Thesis
Fred Vincent Richard 1977 126 p
Avail: Univ. Microfilms Order No. 77-18670

A geometrical ray model of cylindrical dielectric waveguide modes, capable of characterizing their polarization properties, was extended to include the transverse Goos-Haenchen shifts that occur at each reflection of the ray. Incorporation of the Goos-Haenchen shifts was necessary if the resultant model is to properly describe phenomena involving coupling or transport of mode energy. Due to the elliptical polarization of the modes, it was found that the mode ray is displaced, after reflection, not only along the plane of incidence, but perpendicular to it. The direction of the lateral displacement was dependent upon the sense of the polarization of the incident ray. Dissert. Abstr.

N78-14199 Princeton Univ., N. J.
CAPACITY AND CODING FOR BROADCAST CHANNELS Ph.D. Thesis
William Joseph Leighton, III 1977 215 p
Avail: Univ. Microfilms Order No. 77-19177

The problems of determining the capacity region and designing implementable coding techniques for the discrete memoryless broadcast channel are considered. In particular, new and generally improved inner bounds on the capacity region are presented. Parity check and trellis encoders are described which allow reliable transmission of information at rates exceeding those attainable using the usual engineering solution of time-sharing the transmitter between the receivers. Dissert. Abstr.

N78-14200 Pennsylvania Univ., Philadelphia.
SIDELOBE CONTROL IN SUB-NYQUIST SAMPLING Ph.D. Thesis
David Garth Leeper 1977 252 p
Avail: Univ. Microfilms Order No. 77-19880

The penalty for sub-Nyquist sampling in the spatial domain, specifically for phased array antennas, is high peak sidelobe levels. Finding an optimum set of element locations for a sub-Nyquist or thinned phased array is not a trivial task. Ironically, the best developed theory to date for such arrays is the theory of the random array in which element locations are selected according to some probability distribution. In addition to the random array theory, the 1960's saw the development of many ad hoc thinning algorithms. While the algorithms produced a number of small array designs (10's of elements) with some apparent control of peak sidelobe level, the published patterns often showed level and character similar to the random array. Dissert. Abstr.

N78-14201 Northeastern Univ., Boston, Mass.
MAXIMUM-LIKELIHOOD SEQUENCE ESTIMATION TECHNIQUES FOR DATA TRANSMISSION AND THEIR PERFORMANCE ON SEVERAL CHANNEL MODELS Ph.D. Thesis
Paul C. Meng 1976 132 p
Avail: Univ. Microfilms Order No. 77-17789

The objective was to find methods for reducing the computational complexity of the Viterbi decoder. Various methods were considered, and one new technique was proposed that employed the decision feedback principle with the Viterbi algorithm. The error rate performance of the proposed technique was analyzed, evaluated and compared with simulation results for several additive Gaussian noise, time dispersive channel models. Simulation results have shown the proposed technique yields good performance advantages and was computationally efficient relative to other known techniques. The error rate performance of the proposed technique was also evaluated over a slowly Rayleigh fading, frequency selective multipath channel with diversity and shown to be effective in dealing with the intersymbol interference over such a channel. Dissert. Abstr.

N78-14202 Stanford Univ., Calif.
THE FORMATION OF TEMPLATES FROM NATURAL DATA PATTERNS Ph.D. Thesis
Robert Erhard Melen 1977 115 p
Avail: Univ. Microfilms Order No. 77-18227

Signal averaging procedures used to create virtually noise-free templates from sets of natural data patterns are presented. It is assumed that a large number of data patterns are available that consist of replicas of a basic underlying waveform, the signal of interest. These replicas vary in time alignment, time stretch, amplitude bias, and amplitude stretch. It is further assumed that the data waveforms are corrupted with zero-mean white additive noise. The procedures adjust the alignment, bias, and stretch of the data waveforms to obtain a best fit to matching reference, then average the data waveforms to reduce the additive noise. Noise-induced residual misalignments and misadjustments of the data waveforms introduced a distortion in the averaged template; the analysis focuses on the nature and magnitude of this distortion. Dissert. Abstr.

N78-14203 Stanford Univ., Calif.
SUPPRESSION EFFECTS ASSOCIATED WITH VLF TRANSMITTER SIGNALS INJECTED INTO THE MAGNETOSPHERE Ph.D. Thesis
Rajagopalan Raghuram 1977 120 p
Avail: Univ. Microfilms Order No. 77-18241

Magnetospheric growth of coherent VLF signals transmitted from Antarctica is inhibited by whistler mode echoes of earlier transmitter signals. The echoes reduce triggering of emissions as well as the growth of the signal. Echo-induced suppression is not explained by linear wave-wave interference. The echoes are thought to restrict growth by reducing the coherence of the total input signal. Another suppression phenomenon, also discovered from VLF transmissions, is the suppression of mid-latitude hiss by as much as 6db in a band up to 200 Hz wide just below the transmitter frequency. This quiet band develops in 5 to 25 s and lasts up to a minute after the end of transmissions. There is evidence that power-line radiation in the magnetosphere at harmonics of 60 Hz also produces quiet bands. Dissert. Abstr.

N78-14204 Duke Univ., Durham, N. C.
A NEW SYNTHESIS TECHNIQUE FOR FILTERS AND IMPEDANCE MATCHING NETWORKS WITH PARTICULAR RELEVANCE TO MICROWAVES Ph.D. Thesis
Dimitrios Vatis 1976 159 p
Avail: Univ. Microfilms Order No. 77-18785

A simplified but rigorous approach was taken in developing a new synthesis procedure for low pass and impedance matching networks composed of commensurate length transmission line segment in cascade, ladder configurations. The transmission loss function of symmetrical, low-pass configurations was obtained directly from the network's structure upon application of a simple combinatorial algorithm. This eliminated laborious matrix multiplications required by earlier techniques. The derived general transmission loss function was then compared with a transfer function having the desired response to give mathematical relations that specified the characteristic impedances of the lines in the network. The exact design of practical, optimum, networks that heretofore could only be designed using approximate methods was possible using these new techniques and design equations. Dissert. Abstr.

N78-14205 Washington Univ., Seattle.
TWO FREQUENCY MUTUAL COHERENCE FUNCTION AND PULSE PROPAGATION IN CONTINUOUS RANDOM MEDIA: FORWARD AND BACK-SCATTERING SOLUTIONS Ph.D. Thesis
Ippalapalli Sreenivasiah 1976 117 p
Avail: Univ. Microfilms Order No. 77-18419

Pulse propagation characteristics and temporal fluctuation of a wave in a turbulent medium were determined by the two frequency mutual coherence function Gamma. Plane wave two frequency mutual coherence function using the numerical solution to the parabolic differential equation. A parabolic equation for Gamma could be normalized in most practical situations so that Gamma could be given as a function of two normalized variables. Such a normalization was possible if one could approximate the structure function, in a power law form. Numerical solutions of the normalized differential equation were obtained in terms of the normalized variables, and through a simple transformation back to the original variables, the coherence bandwidth, coherence time, pulse shape, and the temporal and angular spectra were obtained in universal forms for the Kolmogorov and the Gaussian spectra of the refractive index fluctuations. Dissert. Abstr.

N78-14206+ Stanford Univ., Calif.
OBSERVED CHARACTERISTICS OF IONOSPHERICALLY PROPAGATED HF ATMOSPHERICS FROM NORMAL AND SEVERE THUNDERSTORMS Ph.D. Thesis
Walter Bruno Zavoli 1977 97 p
Avail: NTIS Avail: Univ. Microfilms Order No. 77-18261

Using a directional HF antenna with a nominal beamwidth of 0.51 deg, atmospherics from midwestern thunderstorms classified as severe, and thus likely to produce tornadoes, were studied in California. The antenna was scanned across regions within a one-hop propagation distance likely to develop tornadoes at the time of the test. These regions were selected on the basis of National Weather Service severe weather forecasts. The existence of strong propagation from these regions at the radio frequencies used was verified by means of backscatter soundings. Analysis of the data recorded in those directions and

periods for which severe storm events were reported led to the discovery of a class of radio atmospherics significantly different from those radiated during normal thunderstorm activity. Atmospherics of this new type take the form of randomly occurring impulses having certain distinctive characteristics. Dissert. Abstr.

N78-14207 British Broadcasting Corp., Kingswood (England). Engineering Div.
AUDIO NON-LINEARITY: AN INITIAL APPRAISAL OF A DOUBLE COMB-FILTER METHOD OF MEASUREMENT
R. A. Belcher Nov. 1977 14 p refs
(BBC-RD-1977/40) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

An objective method of measuring nonlinear distortion of sound signals is described. It uses a test signal comprised of two pseudorandom noise signals whose spectrum occupies most of the audio band. Distortion is measured by using two comb-filters to separate the test-noise signal from distortion products. The method gives better correlation with subjective test results than the conventional total-harmonic distortion method and also reduces the interchannel crosstalk that can arise when testing transmission circuits. It is likely that the cost of equipment for for the new distortion measuring technique could be less than that of total-harmonic distortion equipment. Author

N78-14208 British Broadcasting Corp., Kingswood (England). Engineering Div.
EXPERIMENTAL 704 kbit/s MULTIPLEX EQUIPMENT FOR TWO 15 kHz SOUND CHANNELS
D. F. Reid and N. H. C. Gilchrist Oct. 1977 9 p refs
(BBC-RD-1977/38) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

An outline description is given of equipment which converts two high quality audio signals into digital form, and digitally codes them into a single time division multiplex signal with a bit rate of 704 kbit/s. The equipment is primarily intended to operate with a four phase differential phase shift keying modem and it incorporates special measures in the transmission-error protection system to allow for the error-extension effects which can occur with this type of modulation. The choice of the bit rate and the signal format adopted are discussed. The combined audio-coding and modulation equipment is intended for use with a radio link to form a stereo outside broadcast contribution circuit. Author

N78-14209 British Broadcasting Corp., Kingswood (England). Engineering Div.
TRAFFIC INFORMATION SERVICE: THE DEPENDENCE OF FM CAPTURE EFFECT UPON MODULATION INDEX
D. J. Whythe Oct. 1977 8 p refs
(BBC-RD-1977/35) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

An adaptive system by which receivers can distinguish between messages from a local transmitter (which they should reproduce) and messages from more distant transmitters (which they should disregard) is described. Before radiating its message, the carrier of the message transmitter is frequency modulated by a 125 Hz tone for about 0-5 sec. This is termed the start signal. All the surrounding (ring) transmitters are inoperative for the duration of the message, but during the 0-5 period prior to the message, they radiate carrier waves at reduced power. A circuit tuned to 125 Hz in each receiver responds to the start signal, and if the amplitude of the demodulated signal is large enough, a latch in the receiver is set so that the subsequent message is reproduced. The dependence of the capture effect the modulation index adopted for the start signal is examined. Although the theory assumes infinite-bandwidth discriminators in the traffic-information receivers, the results of brief experiments are described which confirm that a discriminator bandwidth approximately three times that of the peak-to-peak deviation adopted for the start signals would provide adequate performance. Author

N78-14210 British Broadcasting Corp., Kingswood (England). Engineering Div.
A 2.5 GHz CIRCULARLY POLARIZED AERIAL
R. D. C. Thoday Oct. 1977 10 p refs
(BBC-RD-1977/34) Avail: BBC, Kingswood Warren, Tadworth, Surrey England

A circularly polarized aerial for operation in the 2-5 GHz frequency band which can be used in linear horizontal and vertical polarization modes as well as in left or right hand circular polarization modes is described. The aerial was developed for experimental outside broadcast propagation tests at these frequencies. Author

N78-14211*# Ball Bros. Research Corp., Boulder, Colo.
SHUTTLE EXPERIMENTAL RADAR FOR GEOLOGICAL EXPLORATION (SERGE); ANTENNA AND INTEGRATION CONCEPT DEFINITION STUDY Final Report
John W. Kierein 7 Oct. 1977 158 p
(Contract NAS9-15363)
(NASA-CR-151581; F77-23) Avail: NTIS HC A08/MF A01 CSCL 17I

The baseline configuration defined has the SERGE antenna panel array mounted on the OFT-2 pallet sufficiently high in the bay that negligible amounts of radiation from the beam are reflected from orbiter surfaces into the shuttle payload bay. The array is symmetrically mounted to the pallet along the array long dimension with the pallet at the center. It utilizes a graphite epoxy trusswork support structure. The antenna panels are of SEASAT engineering model design and construction. The antenna array has 7 panels and a 7-way naturally tapered coax corporate feed system. The performance of the system is predicted to exceed 33 db gain, have -15 db sidelobes in the E-plane and even lower in the H-plane, and have and E-plane beamwidth less than 2.2 deg, all within performance specification. The primary support structure is predicted to exceed the specified greater than 25 hertz fundamental frequency, although individual panels will have hertz fundamental frequency. Author

N78-14212# Lincoln Lab., Mass. Inst. of Tech., Lexington.
L-BAND AIR-TO-AIR MULTIPATH MEASUREMENTS
A. R. Paradis 6 Sep. 1977 100 p refs
(Contracts DOT-FA77WAI-727; F19628-76-C00002; FAA Proj. 034-241-012)
(AD-A045941; ATC-77; FAA-RD-77-87) Avail: NTIS HC A05/MF A01 CSCL 20/14

A series of air to air earth scattered L-Band multipath measurements were obtained by transmitting RF pulses between two instrumented general aviation aircraft flying coaltitude, diverging paths over a variety of terrain and water surfaces. Multipath data were collected over grazing angles ranging from approximately 5 deg to 75 deg. These measurements were used to characterize the multipath environment in which beacon based airborne collision avoidance (BCAS) equipment would operate, and to investigate the merits and limitations of various degrees of antenna diversity in the rejection of multipath. Author

N78-14213# National Aviation Facilities Experimental Center, Atlantic City, N. J.
NEW YORK CITY PILOTS AUTOMATIC TELEPHONE WEATHER ANSWERING SERVICE (PATWAS) TEST. EXECUTIVE SUMMARY Final Report, Aug. 1975 - Jul. 1976
Frank Staiano and Ephraim Shochet Oct. 1977 14 p
(AD-A046755; FAA-NA-77-23) Avail: NTIS HC A02/MF A01 CSCL 17/2

An improved Pilots Automatic Telephone Weather Answering Service (PATWAS) was subjected to a year-long test in the New York City metropolitan area. The improvements consisted primarily of the following: (1) user access to three route-oriented briefings, (2) an increase in the number of access lines to PATWAS, (3) more frequent updating of information, (4) the addition of special early morning recordings, (5) capability to request meteorological and aeronautical information from the Weather Message Switching Center for incorporation into the PATWAS message, (6) reduction in the time required for updating, (7) addition of more meteorological and aeronautical information to the PATWAS message, (8) new and more efficient magnetic tape equipment, (9) installation of an acoustic enclosure for PATWAS tape recording, and (10) more efficient organization of the message format. Author

N78-14214# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Abt. Thermoelastik.

THERMAL TECHNOLOGY. PART 1: THERMAL PROBLEMS OF SATELLITE ANTENNAS
Oct. 1975 186 p refs In GERMAN; ENGLISH summary
Proc. of 4th DGLR Colloq., Cologne, 23 Oct. 1975
(DLR-IB-152-76/08) Avail: NTIS HC A09/MF A01

Papers are presented in the field of satellite antenna thermal control. The following subjects are discussed: thermally induced vibrations of satellite antenna booms, effects of thermal errors on antenna accuracy and consequences on antenna design, effect of types of thermal insulation on the thermal design of large antennas, thermal control of a satellite truss antenna, thermoelastic behavior of a satellite antenna noting contact-free deformation measurement, and thermal insulating effect of spherical contact surfaces in high vacuum applied to ball bearings. For individual titles, see N78-14215 through N78-14220.

N78-14215# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abt. Festigkeits- und Stabilitaetsprobleme.
THERMALLY INDUCED VIBRATIONS OF SATELLITE ANTENNA BOOMS [THERMISCH INDUZIERTE SCHWINGUNGEN VON SATELLITEN-ANTENNENSTAEBEN]
D. Petersen *In its* Thermal Technol. Oct. 1975 p 7-47 refs In GERMAN; ENGLISH summary (For availability see N78-14214 05-32)
Avail: NTIS HC A09/MF A01

Long storable and extendable cylindrical booms of open cross-section made of beryllium copper are used in space as electric field or gravity-gradient probes. Heated by sunlight, a temperature gradient is built up across the cross-section. The thermal strain produces bending and torsion of the boom. Due to the twist the direction of the sunlight changes with respect to the cross-section and another temperature distribution is obtained which again causes another deformation. This process of interactions may become unstable and so-called thermal flutter is observed. Some principal remarks are made about the system of equations describing the motions, and an example is discussed for the antenna booms of the Helios probe in order to show the stabilizing effect of the centrifugal force. Author (ESA)

N78-14216# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
EFFECT OF THERMAL ERRORS ON ANTENNA ACCURACY AND RESULTING REQUIREMENTS ON ANTENNA DESIGN
W. Schaefer *In* DFVLR Thermal Technol. Oct. 1975 p 49-82 refs In GERMAN; ENGLISH summary (For availability see N78-14214 05-32)
Avail: NTIS HC A09/MF A01

The most important RF-requirements of 12 GHz parabolic antennas with an aperture diameter between 2 and 4 m - especially those concerning the accuracy of the reflector surface - are demonstrated and briefly discussed. The possibilities for mechanical and thermal errors of antennas are summarized, measures to reduce mechanical errors are briefly explained. The most critical thermal loads (critical sun irradiation conditions) and resulting deformations are pointed out and measures to minimize them are discussed. Resulting requirements on the design of antennas are described. Author (ESA)

N78-14217# Dornier-System G.m.b.H., Friedrichshafen (West Germany). Abt. ERT.
THERMAL DESIGN OF LARGE SATELLITE TRANSMITTER ANTENNAS, EXEMPLIFIED FOR THE HLS ANTENNA
R. Marten *In* DFVLR Thermal Technol. Oct. 1975 p 83-94 In GERMAN; ENGLISH summary (For availability see N78-14214 05-32)
Avail: NTIS HC A09/MF A01

The effect of variation of parameters upon the thermal behavior of a satellite transmitting antenna is described. The investigations concern an elliptically edged reflector of 2.6 x 1.5 m for the HLS satellite. In view of the geostationary orbit of the satellite several conditions of solar radiation are considered: vertical and lateral insolation, satellite's and earth's shadow. Various thermal coatings, superinsulation, radomes and satellite radiators are investigated. The use of a radome combined with superinsulation on the rear of the reflector appears to be the optimal thermal design. Author (ESA)

N78-14218# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Unternehmensbereich Raumfahrt.
THERMAL CONTROL OF A SATELLITE TRUSS ANTENNA
K.-H. Reichmann *In* DFVLR Thermal Technol. Oct. 1975 p 95-136 refs In GERMAN; ENGLISH summary (For availability see N78-14214 05-32)
Avail: NTIS HC A09/MF A01

Thermal control calculations of a satellite antenna are described and results are presented. The deployable truss-antenna of 3.5 m in diameter consists of a carbon fiber reinforced composite truss structure and a mesh-reflector. It was designed as a transmitting antenna for a synchronous satellite. Three critical orbit-positions with respect to thermal control, and the eclipse are considered. Simplifying assumptions are discussed. The results show the expected thermal strain and were the basis for the calculation of thermal distortions. Author (ESA)

N78-14219# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.
THERMOELASTIC BEHAVIOR OF A SATELLITE ANTENNA. FEASIBILITY OF CONTACT-FREE DEFORMATION MEASUREMENT
M. Mueller and M. Kirschstein *In* DFVLR Thermal Technol. Oct. 1975 p 137-161 In GERMAN; ENGLISH summary (For availability see N78-14214 05-32)
Avail: NTIS HC A09/MF A01

Some experimental investigations made to determine the thermoelastic properties of a satellite antenna are reported. It was found that deformations under space conditions are of such magnitude that a satisfactory operational performance is not possible. The main reason for the large deformations is the difference in thermal elongation materials of the two covering layers of the sandwich construction. The problems of contact-free deformation measurements are presented in greater detail, and the application of a photogrammetric deformeter is described.
Author (ESA)

N78-14220# Fachhochschule, Aachen (West Germany). Fachbereich Flugzeug-Triebwerksbau.
THERMAL INSULATING EFFECT OF SPHERICAL CONTACT SURFACES IN HIGH VACUUM
W. Hallmann *In* DFVLR Thermal Technol. Oct. 1975 p 163-186 refs In GERMAN; ENGLISH summary (For availability see N78-14214 05-32)
Avail: NTIS HC A09/MF A01

The problems of heat transfer at spherical contact points are clearly outlined. At an environment pressure in the system of 10 to -4th Pa convection and heat transfer of the atmosphere are excluded. Spherical contact surfaces can be applied especially when simultaneously strong forces or moments must be transferred. The practical application of that technique is discussed and demonstrated by an example of ball bearings. Author (ESA)

N78-14221# Hughes Aircraft Co., Culver City, Calif.
THE NULL FILTER MOBILE RADAR FEASIBILITY STUDY Final Report, Apr. 1976 - Mar. 1977
R. A. Birgenheier, C. H. Larson, and J. I. Glaser Jul. 1977 132 p refs
(Contract F19628-76-C-0175)
(AD-A046242; HAC-P77-161; HAC-Ref-D6618; RADC-TR-77-233) Avail: NTIS HC A07/MF A01 CSCL 17/9

The investigation of the Null Filter Mobile Radar (NFMRAD) by state-of-the-art LSI microelectronic hardware was performed. The hardware required for a representative implementation of NFMRAD was investigated and critical hardware items were identified. It was found that the high-precision, high-rate complex multipliers required at each channel of NFMRAD had the major impact on system cost. For the parameters considered in this study, these multipliers add an incremental cost of approximately 300 thousand dollars compared with a more conventional radar design approach. It was found that for the parameters of NFMRAD considered in this study, peak antenna sidelobes of -25 to -30 dB can provide adequate sidelobe clutter suppression for all but severe radar scenarios. A jammer nulling algorithm that takes advantage of the parallel receiving channels of NFMRAD was analyzed and found to work well against a single jammer. An alternate approach to NFMRAD was suggested that could provide

MTI and an ECCM capability with a substantial reduction in price below the price of the full NFMRAD implementation.
Author (GRA)

N78-14222# Ohio State Univ., Columbus. ElectroScience Lab.
BISTATIC SCATTERING BY A TRIANGULAR PYRAMID
John Sahalos and Gary A. Thiele Jun. 1977 32 p refs
(Contract N00014-76-C-0573)
(AD-A046174; ESL-4372-4) Avail: NTIS HC A03/MF A01 CSCL 17/9

The problem of scattering by a triangular pyramid is studied using an extension of the geometrical theory of diffraction by the method of moments. Thus, the current distribution on the faces of the perfectly conducting pyramid is found by solving the three dimensional wedge diffraction problem once for each wedge, or a total of six times. This procedure yields the current in the GTD region on each face. The current near the edge of each wedge is then found using the moment method. The currents so obtained do not include that current caused by tip diffraction. The effect of this current on the far zone field may be added post facto using a formula given by Keller, et al. Results are shown for the bistatic radar cross section and in all cases the results are in good agreement with experimental measurements.
Author (GRA)

N78-14223# R and D Associates, Marina Del Rey, Calif.
EFFECT OF A CYLINDRICALLY-SYMMETRIC IONOSPHERIC DISTURBANCE ON ELF PROPAGATION IN THE EARTH-IONOSPHERE WAVEGUIDE
Carl Greifinger and Phyliss Greifinger 10 Jun. 1977 43 p refs
(Contract DNA001-76-C-0001)
(AD-A046237; RDA-TR-2005-002; DNA-4339T) Avail: NTIS HC A03/MF A01 CSCL 17/2

A nuclear explosion in the earth's ionosphere produces a depression in the ionosphere that is approximately cylindrically symmetric. In this paper, a method is developed for calculating the change in amplitude and phase at a receiver of an ELF (extremely low frequency) radio wave in the presence of such a localized, cylindrically-symmetric disturbance. Numerical results are obtained for the particular configuration where the center of the disturbance is directly above the transmitter-receiver path. The attenuation from one edge of the disturbance to the opposite edge is found to be only about half of that calculated by the two-dimensional WKB approximation usually employed in such problems. GRA

N78-14224# Regis Coll., Weston, Mass.
REDUCTION OF THE UNCERTAINTY OF RADAR RANGE CORRECTION Scientific Report, 1 Oct. 1976 - 1 Jun. 1977
Delia D. DuLong 1 Jun. 1977 26 p refs
(Contract F19628-76-C-0255)
(AD-A046166; AFGL-TR-77-0125; SR-2) Avail: NTIS HC A03/MF A01 CSCL 17/9

A correction for the range error induced by the ionosphere is examined for a representative 425 Mhz radar. A technique has been developed to update the basic prediction of the median so that the residual day-to-day variability of the range correction is reduced. This technique is examined over a descending phase of a solar cycle using measurements of total electron content from Hamilton, Massachusetts. The results show that hourly updating can reduce the residual error in range correction by 60 percent, and three-hourly updating will provide a 30 percent reduction in day-time when the absolute error in range correction is greatest. During periods of rapid changes in TEC such as, sunrise and sunset, and periods of sever magnetic disturbance updating in 15-30 minute intervals is recommended to significantly reduce error. Author (GRA)

N78-14225# Northwestern Univ., Evanston, Ill. Dept. of Electrical Engineering.
GRAPH THEORY AND COMBINATORICS WITH APPLICATIONS TO DIGITAL SYSTEMS AND NETWORKS Summary Report, 1 Jul. 1976 - 30 Jun. 1977
S. L. Hakimi Aug. 1977 9 p refs
(Contract AF-AFOSR-3017-76)
(AD-A045899; AFOSR-77-1247TR) Avail: NTIS HC A02/MF A01 CSCL 17/2

The research problems successfully considered during the past year can be broadly classified into four areas: Communication Networks, Variable Length Codes; Digital Systems and Computer Applications, and Topics in Pure and Applied Graph theory. GRA

N78-14226# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OPTICAL TELECOMMUNICATION PATHS (LINES)
Herman Klejman 15 Mar. 1977 17 p refs Transl. into ENGLISH from Przegl. Telekomun. (Poland), no. 6, 1976 p 173-176
(AD-A045917; FTD-ID(RS)I-0034-77; FTD-77-C-000248) Avail: NTIS HC A02/MF A01 CSCL 17/2

The optical way of sending thru (transmitting) information has in general a multi-century history. Limiting ourselves to its modern parts, one can state that the first tests of optical communication were carried on at the end of the eighteenth century, when there was built in France (in accordance with the Chappe bros. construction), a semaphore telegraph line connecting Paris with Lille. In the period that preceded the introduction of electrical telecommunication, optical communication was the fastest and most efficient way of reaching agreement over even very great distances. The development of the telegraph and telephone, guided and later unguided, pushed aside plans for the problem of optical communication. Only in special application, especially military, did communication on light waves in the infrared area maintain a certain importance (for instance in the course of the second world war optical telephone used to be used for communication over a range of from 3 to 15 km). The invention of the laser (in the year 1960) gave a powerful impulse to the renewal of investigations and experiments in the field of optical telecommunication, and the unattainable-to-this-time properties provided by the laser, of a light beam, (coherence, monochromaticity, and minimum divergence) dazzled the scientists and engineers abruptly by their dazzling prospects. GRA

N78-14227# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OPTIMUM DIVISION OF THE OBSERVATION INTERVAL DURING THE DETECTION OF SIGNALS IN A RADIO LINE WITH ACTIVE RESPONSE
V. M. Katikov 22 Feb. 1977 12 p ref Transl. into ENGLISH from Izv. Leningrad. Elektrotekh. Inst. (Leningrad). no. 98, 1971 p 33-35
(AD-A045995; FTD-ID(RS)I-0189-77; FTD-77-C-000201) Avail: NTIS HC A02/MF A01 CSCL 17/9

The detection procedure in a radar device with active response, in the general case, has two stages. In the first stage (during interval T sub 1) inquiry signals are detected in the receiver of the transponder and in the second stage (interval T sub 2) the reply signals are detected. The quality of detection (probability of errors) in the first and second stages under the influence of interference is determined by values T sub 1 and T sub 2 and therefore, in the case of a limited total observation interval (T = T sub 1 + T sub 2), the problem arises of its subdivision into two parts. Author

N78-14228# Rome Air Development Center, Griffiss AFB, N.Y.
ULTRA-FLAT UHF DELAY LINE MODULES Progress Report, 1 Jul. 1973 - 24 May 1977
A. J. Slobodnik, Jr. and J. H. Silva Jul. 1977 88 p refs
(AF Proj. 4600)
(AD-A046232; RADC-TR-77-257) Avail: NTIS HC A05/MF A01 CSCL 09/5

Delay modules consisting of surface acoustic wave (SAW) delay lines, equalizers, and amplifiers have been implemented. Ultra-flat + or - 0.1 db passband frequency response over a 215 MHz bandwidth centered at 800 MHz has been demonstrated for 7.5 microsec of time delay. Module gain of up to 10 db was achieved. Cascading three modules and using a feedback loop to simulate additional cascade elements demonstrated 500 microsec of time delay over 200 MHz bandwidth in a linear system. Author (GRA)

N78-14229# Aerospace Corp., El Segundo, Calif. Electronics Research Labs.
BROADBAND QUASI-TAPER HELICAL ANTENNAS

Final Report, Jul. - Sep. 1974
J. L. Wong and H. E. King 30 Sep. 1977 35 p refs
(Contract F04701-76-C-0077)
(AD-A046067; TR-0077(2724-01)-2; SAMSO-TR-77-172)
Avail: NTIS HC A03/MF A01 CSCL 09/5

A unique approach is described for widening the bandwidth of a helical antenna with improved gain, pattern, and axial ratio characteristics. The antenna may be described as a non-uniform or quasi-taper helix, which consists of a combination of uniform and tapered helix sections. Measured patterns, gain, axial ratio, and VSWR for various helical antenna configurations are presented and compared. It is shown that a non-uniform, quasi-taper helix can provide an operating bandwidth twice that of a conventional uniform-diameter helix. Author (GRA)

N78-14230# Stanford Research Inst., Menlo Park, Calif.
PATH INTEGRALS FOR WAVES IN RANDOM MEDIA
Roger Dashen May 1977 116 p refs
(Contract DAHC15-73-C-0370; ARPA Order 2504)
(AD-A045949; SRI-JSR-76-1) Avail: NTIS HC A06/MF A01 CSCL 12/1

The problem of wave propagation in a random medium is formulated in terms of Feynman's path integral. It turns out to be a powerful calculational tool. The emphasis is on propagation conditions where the rms (multiple) scattering angle is small but the log-intensity fluctuations are of order unity - the so-called saturated regime. It is shown that the intensity distribution is then approximately Rayleigh with calculable corrections. In an isotropic medium, the local or Markov approximation which is commonly used to compute first and second (at arbitrary space-time separation) moments of the wave field is explicitly shown to be valid whenever the rms multiple scattering angle is small. It is then shown that in the saturated regime the third and higher moments can be obtained from the first two by the rules of Gaussian statistics. There are small calculable corrections to the Gaussian law leading to coherence tails. Correlations between waves of different frequencies and the physics of pulse propagation are studied in detail. Finally, it is shown that the phenomenon of saturation is physically due to the appearance of many Fermat paths satisfying a perturbed ray equation. GRA

N78-14231# Delaware Univ., Newark. Dept. of Mathematics.
INTEGRAL OPERATOR METHODS IN THE THEORY OF WAVE PROPAGATION AND HEAT CONDUCTION Interim Report
David Colton 1977 60 p refs
(Grants AF-AFOSR-2879-76; NSF MCS-77-02056)
(AD-A045936; AFOSR-77-1249TR) Avail: NTIS HC A04/MF A01 CSCL 20/14

Until recently the method of integral operators as initiated by S. Bergman and I. N. Vekua has been restricted to the case of elliptic equations and the investigation of steady state phenomena. In these lectures we survey the recent developments on the use of integral operators to investigate equations associated with evolutionary phenomena, in particular parabolic equations, pseudoparabolic equations, and the reduced wave equation in a stratified medium. The topics discussed are transformation operators for partial differential equations, reflection principles and their application, the propagation of radio waves around the earth, the propagation of acoustic waves in a spherically stratified medium, low frequency approximations to acoustic scattering problems in a spherically stratified medium, heat conduction in two temperatures, inverse problems in the theory of heat conduction, and Runge's theorem for parabolic equations. Open problems are given at the end of each section.
Author (GRA)

N78-14232# Ohio State Univ., Columbus. ElectroScience Lab.
AN MM-GTD ANALYSIS OF THE RADIATION FROM SLOTS IN PLANAR AND CYLINDRICAL PERFECTLY-CONDUCTING STRUCTURES WITH A SURFACE IMPEDANCE PATCH Interim Technical Report
P. H. Pathak and J. Huang Jul. 1977 61 p refs
(Contract F19628-76-C-0154)
(AD-A046048; ESL-4396-1; Scientific-1; RADC-TR-77-242)
Avail: NTIS HC A04/MF A01 CSCL 20/14

The radiation from a slot in an electrically large, perfectly conducting cylinder partly covered with an impedance surface is treated by a combination of the geometrical theory of diffraction (GTD) and the method of moments (MM). The method is far more efficient than MM solutions of conventional integral equations because a perturbation type integral equation which requires the unknown to be evaluated only over the impedance patch is employed in the present analysis. Furthermore, the GTD method can be systematically incorporated into this perturbation integral equation not only to provide substantial simplifications in the solution, but also to directly treat convex cylinders of variable curvature. Numerical results are presented for the two-dimensional circular cylinder case for different size cylinders, different surface impedance values, and for different size surface impedance patches. The radiation from slots in an infinite, planar perfectly-conducting surface which is partly covered with an impedance surface is also analyzed via the MM-GTD solution of the same perturbation type integral equation as in the cylinder case. A comparison of the antenna pattern calculations for the planar and cylindrical configurations indicates the effects of surface curvature especially in the region of space in which the slot is directly visible. Author (GRA)

N78-14233# Sandia Corp., Albuquerque, N. Mex.
BROADBAND ELECTROMAGNETIC ENVIRONMENTS SIMULATOR (EMES)
Neith Pollard 1977 36 p refs Presented at IEEE Intern. Symp. on Electromagnetic Compatibility, Seattle, 2 Aug. 1977
(Contract EY-76-C-04-0789)
(SAND-77-0039c; Conf-770806-1) Avail: NTIS HC A03/MF A01

A test facility developed for determining the effects of electromagnetic environments on systems and components is described. The facility is capable of producing uniform, vertically polarized, continuous wave (CW) and pulsed fields over the frequency range of dc to 10 GHz. This broadband capability addresses the electromagnetic radiation (EMR) threat and is ideally suited to computer controlled sweeping and data acquisition. The facility is also capable of producing uniform transient fields having the wave shape and magnitude characteristic of a nuclear electromagnetic pulse (EMP) and near lightning. The design consists of a truncated, triplate, rectangular coaxial transmission line. At frequencies below the first resonance of the facility it behaves as a typical coaxial system. Above resonance, a wall of electromagnetic absorbing material provides a nonreflecting termination. Thus, EMES essentially combines the elements of a transmission line and an anechoic chamber. ERA

N78-14234# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
THE ANTENNA TRACKING SYSTEM FOR THE EXPERIMENTAL SHIP STATION [DAS ANTENNENNACHFUEHRSYSTEM FUER DIE EXPERIMENTELLE SCHIFFSSTATION]
Max G. Fey and Ernst Hoermann Dec. 1976 30 p In GERMAN
(DLR-IB-552-76/25) Avail: NTIS HC A03/MF A01

The development of the first phase of the antenna tracking system of the German experimental ship station is presented. The general description includes mechanical construction, drive and control systems, operation mode, and ship position measurement. Technical data and details of mass, moment of inertia, center of gravity, drive control, zero adjustment, and rotation direction of the antenna axis and maximum rotation velocity are also given. ESA

N78-14235# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
CALCULATION OF THE DESIRED ANGLE VALUES FOR THE ALIGNMENT OF A STABILIZED TWO AXIS ROTATING PLATFORM IN AN AIRCRAFT [BERECHNUNG DER WINKEL-SOLLWERTE FUER DIE AUSRICHTUNG EINES STABILISIERTEN ZWEI-ACHSEN-DREHSTANDES IN EINEM FLUGZEUG]
Ernst Hoermann Feb. 1977 24 p In GERMAN
(DLR-IB-552-76/27) Avail: NTIS HC A02/MF A01

A procedure to calculate from the navigation gyroscope values the desired values for the drive control of an antenna rotating

platform (azimuth and elevation) on board an aircraft is described. The study is part of the scatterometer project in which the possibility of establishing from backscatter measurements, information on the motion of the sea and hence the wind direction and the wind force was investigated. To this end, a stabilizing antenna pointed slanted towards the sea is mounted on board an aircraft flying along a predetermined path. The position of the antenna should not be influenced by the movements of the aircraft. The method gives simplified equations for 'elevation over azimuth' and for 'azimuth over elevation' values. ESA

N78-14236# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).
INFLUENCE OF THE ATMOSPHERIC PROPAGATION MEDIUM ON SIGNAL TRANSMISSION IN THE L AND KU BAND [EINFLUSS DES ATMOSPHAERISCHEN UEBERTRAGUNGSMEDIUMS AUF DIE SIGNALUEBERTRAGUNG IM L- UND KU-BAND]
R. Makaruschka Dec. 1976 54 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(Rept-9-76) Avail: NTIS HC A04/MF A01

The influence of the propagation medium (troposphere, ionosphere) on the performance of a high precision radar for satellite observation in the L- and KU-band (1.2 and 18 GHz) frequency range is described. An electromagnetic wavefront will be affected and disturbed by atmospheric inhomogeneities because of the turbulences (fluctuations of the air temperature, air pressure, water vapor pressure), of the hydrometeors and of the fluctuation of the electron content in the ionosphere. A special aim of this survey was to investigate whether and up to which amount the signal processing of a radar system will be affected by systematic and statistical measurement errors of the evaluation angle, ranges and Doppler frequency. The possibility of applying theoretical propagation models of the atmosphere, to the above frequency range was studied. Methods are mentioned to compensate systematic errors by real time measurements of atmospheric emission. Author (ESA)

N78-14237# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).
DESIGN AND CONSTRUCTION OF A TROPOSCATTER SIMULATOR AND A DELAY ANALYZER [ENTWURF UND AUFBAU EINES TROPOSCATTER-SIMULATORS SOWIE EINES LAUFZEITANALYSATORS]
K. Rosenbach Mar. 1977 33 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(Rept-1-77) Avail: NTIS HC A03/MF A01

The principle and technical realization of a troposcatter communication channel simulator are described. The simulation is based on the WSSUS-model which is a troposcatter model developed by P. A. Bello. The simulator consists basically of a canonical filter, i. e. a tapped delay line. The tap weights are represented by complex valued Gaussian processes. The principle and performance of a scatterlink analyzer essentially using a serial multichannel correlation filter are also described. Both the scatter simulator and the scatter analyzer will be used for analyzing the scatterlink Leiselheim - Werthhoven and for investigating adaptive signal processing schemes that might be implemented in this link. Author (ESA)

N78-14238# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
ANALYSIS OF GRAVITATIONAL ANTENNA NOISE WITH THE EQUIVALENT CIRCUIT METHOD [ANALISI DEL RUMORE DELL'ANTENNA GRAVITAZIONALE COL METODO DEL CIRCUITO EQUIVALENTE]
G. V. Pallottino Feb. 1977 64 p refs In ITALIAN
(LPS-77-3) Avail: NTIS HC A04/MF A01

Various components of gravitational wave antenna noise were analyzed: contributions from the system antenna-piezoelectrics; preamplifiers contributions; and contributions from the data digitalization. Also considered are uncertainty effects in convection with the quantized nature of energy and the consequences of the indetermination principle. The various noise contributions are subdivided into white noise, that is, noise with constant spectrum in the observation band, and into resonant noise, that is, noise with Lorentz spectrum centered around the antenna resonance. ESA

N78-14239# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
CALIBRATION METHODS FOR A GRAVITATIONAL ANTENNA [METODI DI CALIBRAZIONE DI UNA ANTENNA GRAVITAZIONALE]
U. Giovanardi and G. V. Pallottino Feb. 1977 20 p refs In ITALIAN
(LPS-77-6) Avail: NTIS HC A02/MF A01

Two techniques are considered. The first one uses a capacitor consisting of an end plate of the cylinder and an opposite plate. The second method uses auxiliary piezoelectric ceramics in addition to the measuring ceramics. Calibrating at low energy level is discussed briefly. Calculations of the force between the plates of a capacitor and of the oscillator response according to the Laplace transformation method are appended. ESA

N78-14240# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
RADIATION RESISTANCE FOR LONG DIPOLES IN THE IONOSPHERIC PLASMA
E. Amata and M. Dobrowolny May 1977 50 p refs
(LPS-77-14) Avail: NTIS HC A03/MF A01

The radiation resistance of a long dipole, a long tetherline hooked up to Spacelab, in the ionospheric plasma is discussed. The main features of the cold plasma dispersion relation in the frequency range of interest are recalled. The general formulation of Wang and Bell for the antenna radiation resistance is discussed. The numerical results of the antenna radiation resistance calculations for the case where the dipole antenna is perpendicular to the background magnetic field are presented. The main features of the radiation pattern of the antenna at various frequencies are presented in the case of perpendicular orientation where the antenna in the frequency range considered is a most efficient radiator. The capability of very long antennas to irradiate significant quantities of energies in the surrounding ionospheric plasma, so that subsequent wave phenomena and wave-particle interactions could be profitably studied in a planned Spacelab experiment, are estimated. ESA

N78-14241# Chalmers Univ. of Technology, Goteborg (Sweden). Inst. for Electromagnetic Field Theory and Plasma Physics.
NOTE ON PARAMETRIC INTERACTIONS INVOLVING FREQUENCY MODULATED PUMPS Research and Training Programme on Controlled Thermonuclear Fusion and Plasma Physics (EUR-NE)
D. Anderson and A. Bondeson 1977 8 p refs Sponsored by EURATOM
(CTH-IEFT/PP-1977-3) Avail: NTIS HC A02/MF A01

Some simple results are presented for the average growth-rate of parametric processes involving frequency modulated pumps. A comparison with the case of random pump phase modulation is also made. Author (ESA)

N78-14242# Chalmers Univ. of Technology, Goteborg (Sweden). Inst. for Electromagnetic Field Theory and Plasma Physics.
RESONANT WAVE INTERACTIONS IN INHOMOGENEOUS MEDIA
D. Anderson 1977 15 p refs Sponsored by EURATOM
(CTH-IEFT/PP-1977-4) Avail: NTIS HC A02/MF A01

Using a simple physical approach the maximum amplification of parametric processes in inhomogeneous plasmas was determined for various cases including arbitrary wave dampings. The analysis was extended to include the pump wave equation assuming heavy damping of one of the decay waves (nonlinear Landau damping). The inhomogeneity in this case decreases the energy transfer between the modes as compared to the homogeneous situation. Author (ESA)

N78-14243# Chalmers Univ. of Technology, Goteborg (Sweden). Inst. for Electromagnetic Field Theory and Plasma Physics.
INTERACTION BETWEEN STABLE AND INSTABLE WAVES BY NONLINEAR COUPLING TO A QUASIMODE Research and Training Programme on Controlled Thermonuclear Fusion and Plasma Physics (EUR-NE)
A. Bondeson 1977 10 p refs Sponsored by EURATOM
(CTH-IEFT/PP-1977-5) Avail: NTIS HC A02/MF A01

The steady state, in space and time, of a non-explosive-type three-wave interaction involving a linearly unstable pump and

two damped decay modes was studied. The stability of the steady state was investigated in the limit when one of the decay modes is heavily damped. Explicit criteria for absolute and convective instabilities are presented. Author (ESA)

N78-14244# Centre National d'Etudes Spatiales, Toulouse (France).
SIMULATION OF NONLINEARITIES [SIMULATION DES NON LINEARITES]
Jacques Sombrin Jul. 1977 113 p refs In FRENCH; ENGLISH summary
(CNES-NT-74) Avail: NTIS HC A06/MF A01

The principles used in implementing subroutines to simulate linear or nonlinear transmission paths are described. The simulated elements are: traveling wave tubes (amplitude and phase); Butterworth, Chebyshev, elliptical, and cosine roll-off filters; frequency and phase analog modulators and demodulators; and biphase and quadriphase modulators and demodulators. A fast Fourier transform is used to compute time or frequency representation of the signals. The simulation program is able to optimize the complete transmission path, particularly the nonlinear elements backoff. Author (ESA)

N78-14245# Electricity Council Research Center, Capenhurst (England).
SPEECH PROCESSING FOR RADIO TELEPHONY
P. F. Raven Jun. 1977 31 p refs
(ECRC/R1057) Avail: NTIS HC A03/MF A01

Investigations into the effect of speech processing in maximizing intelligibility for minimum source energy consumption are reported. This is related to the use of double sideband suppressed or diminished carrier for long-range personal radio telephones; however, the results are also applicable to other modulation techniques. Author (ESA)

N78-14246# Office of Telecommunications, Annapolis, Md.
LASER AND ELECTRO-OPTICAL INTERFERENCE CONSIDERATIONS AT RADIO FREQUENCIES
Robert T. Watson Mar. 1977 68 p refs
(PB-271355/0; OTR-77-116) Avail: NTIS HC A04/MF A01 CSCL 17B

The interference potential between radio spectrum systems and laser and/or electro-optical systems was examined. Emissions of laser/electro-optical systems and devices were reviewed, laser/electro-optical applications were identified, RF emissions associated with laser/electro-optical systems were considered, and susceptibilities of these systems were stated. It was determined that EMC problems at RF may exist in systems operating above 3000 GHz. Furthermore, radiated RF could be a problem in particular systems. The radiated RF signal levels and RF susceptibility levels of laser/electro-optical systems are generally unknown and need to be determined. GRA

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N78-14247 British Library Lending Div., Boston Spa (England).
PRINCIPLES OF INSULATION DIMENSIONING
J. Eisler Jun. 1977 31 p refs Transl. into ENGLISH fron Elektrotechnika (Budapest), v. 50, no. 5-6, 1957 p 161-167
(BLL-RTS-10629) Avail: British Library Lending Div., Boston Spa, Engl.: £15.00; 14 BLL overseas, 15 European or 60 UK BLL photocopy coupons

The dimensioning of insulations is considerably simplified by dividing them up into groups, namely embedded electrodes, supporting insulation and lead-in insulation. The properties of the individual groups and the method of their dimensioning are elaborated. It is shown that the most space is taken up by lead-in insulation, and the least by embedded electrodes. From this it follows that wherever possible, embedded electrodes should be substituted for lead-in-type insulations. Author

N78-14248 British Library Lending Div., Boston Spa (England).
ON A METHOD FOR STUDYING TRANSIENTS IN ELECTRICAL CIRCUITS
G. Ya. Beregovenko May 1977 8 p refs Transl. into ENGLISH from Mat. Modelirovanie i Teoriya Elektr. Tsepei (USSR), v. 12, 1974 p 86-89
(BLL-RTS-10538) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

The point method, which is designed to evaluate transients in electrical circuits, is based on the following concepts: the point image of a continuous function; the rules for manipulating point images; and the rules for transforming the images into the originals, or continuous functions. The following tasks were formulated in this study: (a) establish the relations between the image and the original in such a way that the approximation obtained should, in principle, at least differ as little as possible from the precise solution of the given differential equation; (b) obtain the forms of the integrating and differentiating matrices without recourse to numerical methods, which will enable us to write the solution in the form of its analytical dependence on the equation coefficients. Solving these tasks enables construction of a method for studying transients in electrical circuits which is distinct from the point method and which makes is possible not only to obtain a numerical value for the solution of the given differential equation but also to carry out a closed form analysis of that solution. Author

N78-14249 British Library Lending Div., Boston Spa (England).
DETERMINING THE BASIC GEOMETRICAL DIMENSIONS AND WINDING SPECIFICATIONS OF SLOTLESS ELECTRIC MOTORS
A. Ya. Zubko and Ye. M. Shvets Jun. 1977 9 p refs Transl. into ENGLISH from Probl. Tekhn. Elektrodinamiki (Kiev), v. 52, 1975 p 44-48
(BLL-RTS-10638) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

If brushless dc motors are represented in the form of an electro-magnetic model, a direct link may be drawn between the geometrical dimensions of the machine and its basic characteristics by calculating the magnetic energy stored in the machine. Since the material from which the stator is made generally exhibits a high degree of permeability, the only substantial reserve of magnetic energy will be found in the air gap and in the rotor, which is itself a cylindrical permanent magnet. A method is described and used to calculate the geometrical dimensions for a machine which should have a nominal moment value of .00235 HxM, a rotating speed of 9,000 rpm a feed voltage of 12 volts dc, two-pole switching and a switching angle of 120 deg. Tests on a machine made to these specifications yielded a good degree of agreement between the estimated and experimentally obtained characteristics of the machine. Author

N78-14250 Stanford Univ., Calif.
UPPER AND LOWER BOUNDS TO OSCILLATOR STRENGTHS Ph.D. Thesis
Michael Ted Anderson 1977 99 p
Avail: Univ. Microfilms Order No. 77-18195

Experimental and theoretical oscillator strength determinations are reviewed and assessed on the basis of reliability, and the difficulties associated with each of the usual criteria for assessing the accuracy of theoretical calculations are examined. The method of upper and lower bounds is proposed as a source of accurate oscillator strength data with an internal measure of reliability. The foundation of the upper and lower bound formulas, Gram determinantal inequalities, are also reviewed and three separate aspects of upper and lower bounds to transition moments and oscillator strengths are examined: (1) the calculation of rigorous upper and lower bounds to oscillator strengths, (2) the relative accuracy of length and velocity forms in oscillator strength calculations, and (3) the lifetime of the AR XVII 2 superscript 3 S state. Dissert. Abstr.

N78-14251 British Library Lending Div., Boston Spa (England).
CATHODIC BEHAVIOR OF THE MANGANESE DIOXIDE ELECTRODE IN NON-AQUEOUS ORGANIC ELECTROLYTES
K. Matsuki Jul. 1977 19 p refs Transl. into ENGLISH from Nihon Kagaku Kaishi (Japan), v. 9, no. 2, 1976 p 237-242
(BLL-RTS-10816) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

The cathodic behavior of MnO2 electrodes in electrolytes of LiClO4 dissolved in propylene carbonate, tetrahydrofurane, dimethyl sulphoxide, and gamma butyrolacetone, was investigated. Studies were done by using an electric potential scanning method and a steady current discharge method. Heat treatment conditions were found to have a large effect on the electrochemical activity of the MnO2; maximum discharge capacity occurring with a MnO2 electrode heat treated in air at 200 C and inactivity occurring with drying at room temperature and vacuum heat treatment. The viscosity of the electrolyte used also affected the cathode reaction. An apparent utilization factor/percentage was obtained from the ratio of the quantity of electricity used for electrodeposition to the amount gotten on discharge. This factor decreased when the electrolytic layer became thick, or when the discharge current density became high. Author

N78-14252 British Library Lending Div., Boston Spa (England).
DEFINING THE THROWING POWER OF ELECTRO-PLATING ELECTROLYTES USING MEASUREMENTS TAKEN WITH THE HARING-BLUM CELL
J. Korpiun Oct. 1977 12 p refs Transl. into ENGLISH from Metalloberflache (West Germany), v. 31, no. 3, 1977 p 118-121
(BLL-RTS-10811) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

The formulas previously used for evaluating the throwing power measurements taken with the Haring-Blum cell are arbitrary. It is shown that in a simple way and without making any additional assumptions a mean throw parameter can be deduced from these measurements which should therefore be used for defining the behavior of galvanic baths. An indication about the most suitable cell current for checking electroplating baths for the measurements is given. Author

N78-14253 British Library Lending Div., Boston Spa (England).
INVESTIGATION OF NICKEL DEPOSITION FROM WATTS BATHS BY MEANS OF DYNAMIC IMPEDANCE AND CURRENT DENSITY POTENTIAL CURVES
B. Droste and H. G. Feller Oct. 1977 23 p refs Transl. into ENGLISH from Metalloberflache (West Germany), v. 31, no. 1, 1977 p 1-6
(BLL-RTS-10800) Avail: British Library Lending Div., Boston Spa, Engl.: £15.00; 14 BLL overseas, 15 European or 60 UK BLL photocopy coupons

The influence of three organic substances, naphthalene trisulphonic acid, butyne diol, and coumarin, on nickel deposition from Watts' baths was investigated by simultaneously recording the current density and impedance potential curves. The log/i/-U curves include two Tafel gradients which are lower at high deposition current densities than at low current densities. This electrokinetic behavior suggests a two stage mechanism of nickel electrocrystallization, in which (NiOH)ads apparently acts as an intermediate product, formed in the first reaction stage and consumed in a second stage in discharging the Ni(2+) ions. The impedance potential measurements showed that at potentials below the deposition potential U sub a the phase boundary behaves inductively. This effect is attributed to a faradic current set up by the the fluctuation in (NiOH)ads coverage, with an inductive phase shift relative to the superimposed ac voltage. The effects of the organic additives are summarized. Author

N78-14254 British Library Lending Div., Boston Spa (England).
MODELLING OF STATIC AND DYNAMIC PROPERTIES OF TRANSISTORS ON THE ANALOGUE COMPUTER
D. Reschke Nov. 1977 16 p refs Transl. into ENGLISH from 12th Intern. Sci. Colloq. (West Germany), Sep. 1967 p 117-123
(BLL-RTS-10954) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

Techniques in generating transistor models, by measuring characteristics on a real transistor and comparing them with characteristics of an idealized transistor, were described. Reproduction of static properties of a transistor on the analogue computer was investigated through models and simulation. Shockley equations were utilized in modelling. Dynamic properties were modelled using emitter diffusion, emitter barrier layer, collector diffusion, and collector barrier layer capacitances. Author

N78-14255 British Library Lending Div., Boston Spa (England).
ELECTRIC TUNGSTEN-BROMINE CYCLE LAMP
Nov. 1977 9 p Transl. into ENGLISH of Dutch patent no. 75.11741 9 p
(BLL-RTS-10978) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

An electric tungsten-biomine cycle lamp is described in which a tungsten filament is disposed in a light-transmissive bulb containing an inert gas, bromine, hydrogen, and phosphorus, characterized in that the bulb contains 2,2-diamino-4,4,6,6-tetrabromo-2,2,4,4,6,6-hexahydrotriazaphosphine, 6,6-pentabromo-2,2,4,4,6,6-hexahydrotriazaphosphine, mixtures thereof, or their thermal dissociation products. A method is present of making an electric tungsten-bromine cycle lamp having a tungsten filament disposed in a light-transmissive bulb containing an inert gas, bromine, hydrogen, and phosphorus, characterized in that through an opening in the wall of the bulb a solution is introduced into the bulb, the solvent is evaporated and the bulb is filled with an inert gas and sealed. Author

N78-14256 British Library Lending Div., Boston Spa (England).
FURTHER DEVELOPMENTS IN DIRECT CURRENT INSTRUMENT TRANSFORMERS
Rudolf Zahorka Aug. 1977 14 p refs Transl. into ENGLISH from AEG Mitt. (West Germany), v. 49, no. 10/11, 1959 p 606-609
(BLL-RTS-10794) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

The error properties of a dc transformer in series connection are discussed, and improved dc instrument transformers of high accuracy for high primary current strengths are described. Information is given on dc instrument transformers of lower accuracy, as used in normal or any of the manifold special circuits, notably in monitoring and control engineering. Author

N78-14257 British Library Lending Div., Boston Spa (England).
EFFECT OF CARBON IN SILICON SINGLE CRYSTALS ON THE CHARACTERISTICS OF SEMICONDUCTOR DEVICES
M. Yokozawa Aug. 1977 15 p refs Transl. into ENGLISH from Nat. Technical Rept. (Japan), v. 22, no. 2, 1976 p 194-200
(BLL-RTS-10740) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

Carbon impurities and lattice defects in silicon crystals were investigated and their relation with electrical characteristics of semiconductor devices was clarified. It was shown that carbon affects diode reverse characteristics. To clarify this effect quantitatively, experimental diodes using silicon crystals containing from 0.1 to 7 ppma of carbon were produced. Results of observations in the lattice defects in silicon crystals were discussed. Author

N78-14258 British Library Lending Div., Boston Spa (England).
THE TRANSMISSION SYSTEM PCM30D FOR THE DIGITAL DATA TRANSMISSION NETWORK
J. Domer, Friedrich Kuehne, Karl Lang, and Herbert Schueler Apr. 1977 22 p refs Transl. into ENGLISH from Nachrichtentech. Z. (West Germany), v. 30, no. 2, 1977 p 149-155
Avail: British Library Lending Div., Boston Spa, Engl.

The transmission system PCM30D designed for the construction of the nationwide integrated telex and data network is described. The system is comprised of a data multiplex equipment for 30 data channels with a nominal bit rate of 64 kbit/s per

channel, a data insertion equipment for four such data channels, and a line installation for further transmission of the 2048 kbit/sdata signal prepared in the data multiplex equipment. The transmission and padding processes are briefly described along with the equipment. Author

N78-14259 British Library Lending Div., Boston Spa (England).
REALIZATION OF A PCM SWITCHING STAGE
F. Melindo and G. Perucca Apr. 1977 18 p refs Transl. into ENGLISH from CSELT Rappt. Tecnici (Turin), no. 2, Dec. 1973 p 39-46
(BLL-PO-3456-(9022.81)) Avail: British Library Lending Div., Boston Spa, Engl.

A description is given of the realization of a time division digital switching stage for 1024 PCM channels. The stage has full accessibility and no internal blocking. It has a time division structure only, based on fast memories and a multiplexer with an input/output matrix. The operation of the system is illustrated by means of time domain drawings and diagrams. Mention is also made of the circuit techniques and configurations adopted. In conclusion, consideration is given to the performance of the stage, which is intended to be used in prototypes of electronic switching equipment. Author

N78-14260 British Library Lending Div., Boston Spa (England).
RELAXATION EFFECTS AT SEMICONDUCTOR-INSULATOR INTERFACES
M. Zerbst Apr. 1977 14 p refs Transl. into ENGLISH from Z. Angew. Phys. (West Germany), v. 22, no. 1, 1966 p 30-33
(BLL-PO-3460-(9022.81)) Avail: British Library Lending Div., Boston Spa, Engl.

Relaxation mechanisms such as volume and surface generation, charging of surface states, and charge transfers in the insulator may be identified from time dependence of the MOS capacitance after applying a voltage step. The measuring method described allows the separation of the various mechanisms and the determination of bulk lifetime, surface recombination velocity, and the time constant of carrier emission from surface states. Experimental results obtained with thermally oxidized n-type silicon are given. Author

N78-14261 British Library Lending Div., Boston Spa (England).
DEVELOPMENT OF STRONG DUCTILE ALUMINUM ALLOY CONDUCTOR
Karaki and M. Takahashi Sep. 1976 10 p ref Transl. into ENGLISH from Dainishi-Nippon Cables Rev. (Japan), no. 61, Sep. 1976 p 51-53
(BLL-CE-Trans-7155-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.

The effect of weight loading, atmospheric oxygen, and continuous current load in ring sleeve joints was examined in the hopes of wiring a house with aluminum cable by the same techniques as for copper cable. The mechanism of solderless joint deterioration was studied along with alloys and connectors for ring sleeves applicable to aluminum wire. Cyclic current heating tests were performed on compression sleeves of semi-hard EC aluminum and annealed copper. Results are presented and briefly discussed. J.M.S.

N78-14262 British Library Lending Div., Boston Spa (England).
TEST DESK FOR RELIABILITY STUDIES OF ELECTRONIC COMPONENTS
E. Poppe, H. Hart, and G. Hartig Aug. 1976 7 p refs Transl. into ENGLISH from Feingeraetetechnik (East Germany), v. 24, no. 10, 1975 p 469-470
(BLL-Trans-3379-(9022.81)) Avail: British Library Lending Div., Boston Spa, Engl.

A test desk was developed in order to study the relationship between 'life' and test failure rates, as well as other physico-technical characteristic values, such as nonlinearity of the characteristic curves, parameter drift or parameter distributions. The design followed general technical and testing requirements and provided for the following possibilities: use of the current level as a test parameter and use of voltage drop over the test piece as a test magnitude; realization of different current loads by variable test circuits, while the other tests conditions were maintained constant; performance of long term and short term tests, automation of error recognition, fault location and elimination, storing of the test results and automated test data output; and universal application both as regards the test pieces and also the insertion areas. Author

N78-14263 British Library Lending Div., Boston Spa (England).
CALCULATION OF STRAY CAPACITANCES IN PRINTED CIRCUIT RADIO EQUIPMENT
L. M. Kononovich Jan. 1977 12 p refs Transl. into ENGLISH from Izu. Vyssh. Ucheb. Zaved., Radiotekh. (USSR), v. 11, no. 8, 1956 p 64-70
(BLL-PO-3450-(9022.81)) Avail: British Library Lending Div., Boston Spa, Engl.

The method of calculation is explained and numerical formulas are presented for determining the self-capacitances of printed conductors. Formulae for the capacitances are determined by the method of conformal transformations of printed conductors of various configurations into a coaxial long line. Author

N78-14264 Pennsylvania Univ., Philadelphia.
IDENTIFICATION AND OPTIMAL LOAD-FREQUENCY CONTROL OF INTERCONNECTED POWER SYSTEMS Ph.D. Thesis
Soleiman Kalimi Kashanian 1977 219 p
Avail: Univ. Microfilms Order No. 77-19870

A method is presented for the estimation of the random load spectra from tie-line power and frequency measurements under normal operation of interconnected power systems. The estimated load fluctuation spectra were then used to optimize the load-frequency controller parameters based on a quadratic performance criterion. Performed computation analysis of recorded frequency data supplied by an electric utility company showed that the frequency autocorrelation function exhibits characteristics of Poisson distribution. This substantiates the necessity of treating load disturbances as random processes for the search of optimal control. The parameter optimization technique presented has the advantage of enabling one to choose a set of free load-frequency controller parameters for the widest stability margin.
Dissert. Abstr.

N78-14265 Michigan State Univ., East Lansing.
THE PATH CHECKING METHOD APPLIED TO MULTIPLE FAULT ANALYSIS OF SWITCHING CIRCUITS Ph.D. Thesis
Tze Tzong Chen 1976 215 p
Avail: Univ. Microfilms Order No. 77-18466

The path checking method is presented for the fault detection and diagnosis of switching circuits, both combinational and sequential. In the case of sequential circuits, signal flowed in the circuits and their relevance to the state diagram could be exposed by this method which further facilitated the fault analysis. Using this method, every path of the switching circuit was checked for its ability to pass both signals, 0 and 1. The same approach was applied to both combinational and sequential circuits, with the sequential circuits treated as an extension of the combinational circuits. Thus, for sequential circuits, the fault analysis was conducted at the circuit level rather than at the state diagram level. The only restriction imposed on the types of circuits that were considered was that every path of the circuits be sensitizable. Dissert. Abstr.

N78-14266 Southern Methodist Univ., Dallas, Tex.
MULTIRATE DIGITAL FILTERS Ph.D. Thesis
Chyi Haw Lu 1977 165 p
Avail: Univ. Microfilms Order No. 77-19159

Recent developments in multirate digital filters are reviewed, and attempts are made to fill a long existing gap between multirate digital filters and multirate sampled-data control systems. It also presents two new approaches to the design and implementation of multirate digital filters with emphasis on their application to interpolation: (1) an FFT implementation relied on block representation and parallel realization. Timing comparisons showed that this method was faster than an earlier FFT technique demonstrated by Gold and Radar. (2) An extension of the Wiener Filter Theory used a recursive procedure based on linear predictive deconvolution. This eliminated the matrix inversion required in solving the Wiener-Hopf Equation and thus simplified implementation, reduced computation and word length, and removed numerical instability. A detailed error analysis was included. An example comparing results obtained from (1) and (2) was given, and the application

of multirate digital filter to seismic data processing was illustrated. Dissert. Abstr.

N78-14267 Arizona State Univ., Tempe.
THE EXACT ONE-DIMENSIONAL MODEL OF THE DOUBLE-INSULATED-GATE FIELD-EFFECT DEVICE Ph.D. Thesis
Michael William Powell 1977 231 p
Avail: Univ. Microfilms Order No. 77-17879

An accurate one dimensional model of the insulator and silicon regions in a double-insulated-gate field effect device is described. The model incorporates the principles of carrier current continuity in the insulators and carrier transport and current continuity in the silicon. Avalanche carrier generation and avalanche carrier injection mechanisms are included. The model is used to theoretically solve the transient response of the metal-silicon nitride-silicon dioxide-silicon structure with a silicon dioxide thickness of 50A. Dissert. Abstr.

N78-14268 Pennsylvania Univ., Philadelphia.
HIGHER ORDER INTERPOLATIVE ANALOG TO DIGITAL CONVERTERS Ph.D. Thesis
George Ray Ritchie 1977 131 p
Avail: Univ. Microfilms Order No. 77-19911

Design of the basic interpolative A/D converter was explored. Improving performance by replacing the simple direct feedback quantizer by some more general quantizer structure, and then replacing the digital filter by a new filter optimized for this new quantizer was emphasized. It is shown that there are certain practical considerations, namely stability and quantizer overload, which make higher order interpolative converters increasingly difficult to implement. It is concluded that in most cases it will be impractical to extend the higher order interpolation technique beyond the fourth order. Dissert. Abstr.

N78-14269 Princeton Univ., N. J.
ON THE RELATIVE EFFICIENCIES OF SOME PARAMETRIC AND NONPARAMETRIC SEQUENTIAL DETECTORS Ph.D. Thesis
Sawasd Tantaratana 1977 214 p
Avail: Univ. Microfilms Order No. 77-19184

Several sequential tests, both parametric and nonparametric, were investigated for the detection of a signal in additive noise. Their efficiencies with respect to fixed-sample-size (FSS) tests were studied. A survey of sequential testing and an extensive study of the sequential sign test for antipodal signal detection were accomplished. The sequential sign test showed a significant saving, under the hypothesis and the alternative, in the average sample size over the optimum FSS detector when both tests have the same error probabilities. The asymptotic relative efficiencies (ARE) of the sequential sign test with respect to various detectors were derived. Sequential multilevel quantizers were investigated. Dissert. Abstr.

N78-14270 British Library Lending Div., Boston Spa (England).
PROPERTIES OF ACTIVELY REALIZED INDUCTANCES AND SUPERCAPACITORS AND THE COMPENSATION OF THE FREQUENCY RESPONSE DEVIATIONS
Helmut Kempfhankel 10 Feb. 1977 23 p refs Transl. into ENGLISH from Frequenz (Berlin), v. 30, no. 8, 1976 p 220-228
(BLL-Trans-3430-(9022.81)) Avail: British Library Lending Div., Boston Spa, Engl.

A circuit for RC active realization of inductances and supercapacitors is analyzed. Frequency response errors caused by the limited gain operational amplifiers with limited input and output resistances are removed very efficiently by suitable dimensioning and application of a useful broadband compensation technique if necessary. Author

N78-14271 British Library Lending Div., Boston Spa (England).
CHARACTERISATION BY ENERGY OF SHORT DURATION NOISE IN LOGICAL SYSTEMS. 1: PARASITIC ENERGY MEASUREMENT ON A LOGICAL CIRCUITS CONNECTION
J. L. Aucouturier, J. P. Dom, G. Lacroix, and J. J. Riviere 15 Mar. 1977 13 p refs Transl. into ENGLISH from Onde Elec. (France), v. 56, no. 10, 1976 p 397-402
(BLL-Trans-3448-(9022.81)) Avail: British Library Lending Div., Boston Spa, Engl.

Short electrical parasites in a logic system, generally assimilated with voltage impulses, were characterized. In effect, the intrinsic characteristic magnitude of the parasite was the energy added to or extracted from the circuit. A method was outlined for determining parasite energy in a connection between logic circuits, and the equipment. Author

N78-14272 British Library Lending Div., Boston Spa (England). Research Dept.
THE SUBSTITUTION OF TRANSFORMERS BY GYRATOR CIRCUITS
D. Boettle and G. Wilberscheid Oct. 1976 13 p refs Transl. into ENGLISH from Frequenz (West Ger.), v. 29, no. 9, Sep. 1975 p 264-267
(BLL-Trans-3405-(9022.81)) Avail: British Library Lending Div., Boston Spa, Engl.

The concept of using gyrator circuits in place of conventional transformers in modern electronic systems was studied. Circuits with gyrators, composed of operational amplifiers and pertinent resistor networks, can sufficiently simulate transformers and take over their functions for special applications. Basic ideas for the development of transformers without coils are summarized and realization problems are examined. Author

N78-14273# Canada Inst. for Scientific and Technical Information, Ottawa (Ontario).
A METHOD FOR THE SYNTHESIS OF MULTILAYER DIELECTRIC INTERFERENCE COATINGS
L. Sossi 1977 12 p refs Transl. into ENGLISH from Izv. Akad. Nauk Est. SSR, Fiz. Mat. (USSR), v. 23, no. 3, 1974 p 229-237
(NRC/CNR-TT-1904; ISSN-0077-5606) Avail: NTIS HC A02/MF A01

The design of a stepped dielectric interference coating with a given transmittance function T(k), where k is the wave vector, is carried out by first finding an inhomogeneous layer satisfying these requirements and then approximating it by a series of dielectric layers. An expression for the refractive index of the inhomogeneous layer as a function of twice the optical thickness is found by using a Fourier transformation. The accuracy of this method is estimated and a way to carry out additional corrections is given. An example is used to illustrate the effectiveness of the method. Author

N78-14274*# Westinghouse Defense and Electronic Systems Center, Baltimore, Md. Systems Development Div.
SOLID-STATE KU-BAND POWER AMPLIFIER Final Report, Aug. 1971 - Aug. 1974
B. D. Geller 10 Feb. 1975 140 p refs
(Contract NAS5-20291)
(NASA-CR-143722; FR-74-1068) Avail: NTIS HC A07/MF A01 CSCL 09A

The design of a 5-watt Ku band solid state power amplifier is described. A survey of IMPATT diodes and negative resistance amplifiers is presented. A single diode reflection amplifier delivering 0.5 watt at 15 GHz with 10db gain over a 1-GHz band was developed. An attempt was made to combine 20 diodes in a radial combiner. The attempt was unsuccessful due to poor understanding of multimode combiners and spurious coupling effects between elemental amplifiers. The design of a dominant mode resonant combiner, the characterization of the IMPATT diodes, and results on the complete amplifier are discussed. The amplifier consists of 12 GaAs diodes, combined in two TM sub 010 cavities which are subsequently combined by a circuit utilizing a magic tee hybrid. Results are also given on the thermal and graceful failure characteristics of the unit. Author

N78-14275*# Microsystems Technology, Inc., Huntsville, Ala.
DESIGN AND QUALITY STANDARDS FOR CUSTOM HYBRID MICROCIRCUITS Final Report
Robert V. Allen 25 Nov. 1977 24 p
(Contract NAS8-32610)
(NASA-CR-150484; DCN-1-7-EC-07661-1F) Avail: NTIS HC A02/MF A01 CSCL 09C

A hybrid microcircuit standard was developed after a thorough review of applicable NASA, military, industry, and technical society specifications and standards and compilation of comments from technical reviewers throughout the hybrid industry. The draft of

the standard submitted to the technical reviewers, the comments from the reviewers, and the completed standard are discussed.
Author

N78-14276# Rome Air Development Center, Griffiss AFB, N.Y.
AN EVALUATION OF INTEGRATED INJECTION LOGIC Final Report, Mar. 1976 - Jul. 1977
Tien Tao and Robert Pierret Aug. 1977 228 p refs
(Contract DOT-FA72WAI-241)
(AD-A046759; FAA-RD-77-137) Avail: NTIS HC A11/MF A01 CSCL 09/5

A relatively new integrated circuit technology is obtained which shows great promise for large scale integration applications. Although it is slow compared to other bipolar logic families, it has the lowest power delay product of any technology, high packing density, and simple processing in certain versions. It has the capability of providing both analog and digital circuits on one chip. It is extremely flexible in that it can be tailored to meet diverse requirements such as light emitting diode drivers and low current watch circuits. Details of processing, theoretical and experimental characteristics, applications, and commercial activities are reported. Author

N78-14277# Raytheon Co., Waltham, Mass. Microwave and Power Tube Div.
HIGH POWER, FLUID COOLED HELIX TWT Quarterly Progress Report, 1 Apr. - 30 Jun. 1977
13 Jul. 1977 10 p
(Contract N00173-76-C-0354)
(AD-A046058; PT-5047; QPR-3) Avail: NTIS HC A02/MF A01 CSCL 09/1

The specific objectives of Phase I of this program (covering the period of 10-76 to 4-78) are (1) to design and develop a reliable beam optical system, focusing mechanism and suitable collector for a high power, high perveance, broadband TWT, (2) to deliver one beam tester suitable for design evaluation and initial systems modulator testing, and (3) to carry out sufficient cold test measurements to design a suitable output coupler with fluid adapter, rf structure, and a cooling mechanism for use in the engineering models to be built in Phase II. Author (GRA)

N78-14278# Rome Air Development Center, Griffiss AFB, N.Y.
DIAGNOSTIC USE OF LIQUID CRYSTAL DETECTORS IN MICROSTRIP ANTENNA DESIGN
John McIlvenna and Nicholas Kernweis Jul. 1977 30 p refs (AF Proj. 4600)
(AD-A046231; RADC-TR-77-250) Avail: NTIS HC A03/MF A01 CSCL 09/1

Liquid crystal detector sheets can be used to visually display the field structure on and around planar antenna structures such as microstrip patch elements and arrays. The display aids in diagnosing feed placement problems in single elements, and pinpoints mismatch and asymmetries in array feeds. The loading effects of the detector sheets is examined and found to be of no serious consequence. Author (GRA)

N78-14279# Pennsylvania State Univ., University Park. Materials Research Lab.
CERAMIC PIEZOELECTRIC TRANSDUCERS Semiannual Report, Jan. - Jul. 1977
L. E. Cross, J. V. Biggers, and R. E. Newnham Jul. 1977 97 p refs
(Contract N00014-76-C-0515)
(AD-A046010) Avail: NTIS HC A05/MF A01 CSCL 09/1

Underpinning the whole effort to prepare new combinations of materials in closely interconnected microstructures is the basic work on ceramic processing. This work can contribute to a better understanding, and thus to better reproducibility of conventional PZT bodies, but its major thrust must be to provide the foundation of electroceramic competence necessary for processing the more sophisticated diphasic systems which are the major hope for significant advance. Significant progress has been made particularly in the tape casting studies and a number of the lamellar heterogeneous structures originally proposed have now been successfully fabricated. Also in the diphasic area a theoretical evaluation of the bounds of possible piezoelectric and pyroelectric properties which could be achieved for some of the simpler types of connectivity in linear elastoelectric materials has been accomplished. This is an essential first step toward the more general consideration of non-linear ferroic systems, where 'self-bias prestressing' may be further exploited to modify possible properties in connected systems.
Author (GRA)

N78-14280# General Electric Co., Syracuse, N.Y. Electronics Lab.
MULTIMODE FILTERS Final Technical Report, 1 Jun. 1976 - 28 Feb. 1977
S. Wanuga, C. M. Stearns, A. L. Kachelmyer, and S. W. Tehon Fort Monmouth, N. J. Army Electronics Command Oct. 1977 211 p refs
(Contract DAAB07-76-C-1337; DA Proj. 1L7-62705-AH-94)
(AD-A046091; ECOM-76-1337-F) Avail: NTIS MF A01 CSCL 09/5

This report describes work on Multi Mode Filters performed from 1 June 1976 to 28 February 1977. The objective of this program is to develop design criteria and establish tradeoffs for the transduction of acoustic bulk waves in crystal stacks, for use in filtering applications. A primary goal of the program is to explore methods of obtaining miniature low-loss acoustic filters using interactions among the three modes in each crystal layer, which depend on the thickness coordinate. This report is concerned with Phase I of this overall Multi Mode Stacked Crystal Filter Program: The detailed requirements of this phase were to consider: (1) Number of crystal plates in the stack. Emphasis is placed on two- and three-plate stacks, exclusive of bonding or coupling layers, relative thicknesses of the plates, and bonds of coupling layers. (2) Materials comprising each crystal plate, bond, or coupling layer. Emphasis is placed on quartz and highly piezoelectric materials, such as lithium niobate. The material parameters used in all of the stacked filter programs are arbitrary; however, most results are illustrated using the material parameters of AT-cut quartz or are illustrated using the material parameters of AT-cut quartz or multiples of them. Results for berlinite are included (Section 2). (3) Number of thickness modes coupled piezoelectrically, in a given plate, to the electrode system. Number of thickness modes, coupled mechanically at the interfaces, for achieving the filter response. Emphasis is placed on one- and two-shear or quasi-shear modes. GRA

N78-14281# Federal Trade Commission, Washington, D.C. Bureau of Economics.
THE SEMICONDUCTOR INDUSTRY: A SURVEY OF STRUCTURE, CONDUCT, AND PERFORMANCE
Douglas W. Webbink Jan. 1977 209 p
(PB-272335/1; FTC/BE/SMCN-77/4) Avail: NTIS HC A10/MF A01 CSCL 05C

Manufacturing of semiconductors, which include diodes, rectifiers, and integrated circuit devices, made from elements, such as silicon and germanium, is described. Due to the continued entry of new firms and the high mobility of its scientists and engineers, the industry has had rapidly falling prices throughout its history, and is an effective competitor in the world market. Vertical integration, mergers and acquisitions, pricing policies, patents, research and development, and the learning curve of the industry are examined. GRA

N78-14282# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
DEVELOPMENT OF IMPROVED SOLDERS FOR ELECTRONIC RELIABILITY Final Report, 15 Mar. 1976 - 12 Apr. 1977
M. C. Denlinger, R. W. Korb, and V. F. Lardenoit Wright-Patterson AFB, Ohio AFML Jun. 1977 110 p
(Contract F33615-76-C-5089; AF Proj. 7351)
(AD-A046213; FR-77-12-376; AFML-TR-77-93) Avail: NTIS HC A06/MF A01 CSCL 11/6

A higher temperature solder alloy intended for use on polyimide printed wiring boards was developed. The solder shows no evidence of cracking after exposure to 500 temperature cycles between 200 C and -55 C. A comparative test with Sn63 between 125 C and -55 C resulted in cracking after 200 cycles. The alloy (90 Pb9 Cd1 Zn) was the result of selecting, testing and modifying all possible alloy systems that would be suitable for printed wiring board application. The resulting alloy, in addition

to providing increased reliability, offers a significant cost reduction over the conventional tin-lead system. GRA

N78-14283# Sandia Labs., Albuquerque, N. Mex.
OPTIMAL NOR NETWORKS FOR SELF-DUAL FUNCTIONS OF FOUR VARIABLES
D. A. Reynolds Jun. 1977 17 p refs
(Contract EY-76-C-04-0789)
(SAND-76-0275) Avail: NTIS HC A02/MF A01

A complete catalog of optimal NOR realizations for all self-dual functions of four or fewer variables is presented. Optimality is achieved by first minimizing the number of gates required, then minimizing the number of gate inputs required, and, finally, minimizing the number of logic levels required to realize the function. Complements of input variables are assumed to be unavailable. ERA

N78-14284# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
ON THE ELECTRICAL EQUIVALENT CIRCUITS OF MULTIPLE SENSOR GRAVITATIONAL WAVE ANTENNAS
G. V. Pallottino and G. Pizzella Mar. 1977 38 p refs
(LPS-77-9) Avail: NTIS HC A03/MF A01

The electrical equivalent circuit of a Weber gravitational wave antenna was derived for various longitudinal normal modes, using the Lagrangian formulation. The analysis was applied to the antenna without piezoelectric ceramics, and to the antenna with one or more ceramics operated both in passive and in active mode. Particular attention was given to the dissipation problem in order to obtain an expression of the overall merit factor that is directly related to the physics of the actual dissipation processes. The results were applied to an example in which two ceramics are used: one for calibrating the antenna and the other to observe its motion. The value of the physical parameters and of the pertinent parameters of the equivalent circuit for the small and the intermediate antennas (predicted) are given in the appendix. Author (ESA)

N78-14285# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
OPTIMIZATION OF THE PIEZOELECTRIC TRANSDUCER FOR A CRYOGENIC GRAVITATIONAL WAVE ANTENNA
F. Bordoni, G. V. Pallottino (Rome Univ.), and G. Pizzella (Rome Univ.) Apr. 1977 6 p refs
(LPS-77-11) Avail: NTIS HC A02/MF A01

The sensitivity of a gravitational wave antenna, Weber-type, depends on the characteristics of the cylindrical bar, the piezoelectric transducer, and the electronic amplifier. For a given bar it is possible to obtain the highest sensitivity by a proper choice of the total number of piezoelectric ceramics employed and of the number of the FETs used in the preamplifier. The optimization for the intermediate cryogenic bar gives a sensitivity of 11 GPU at 4.2 K. This sensitivity is obtained with two ceramics GULTON 1408 in parallel and a 4 FET preamplifier.
Author (ESA)

N78-14286# Helsinki Univ. of Technology, Espoo (Finland). Lab. of Physics.
RELATIVISTIC EFFECTS IN THE CALIBRATION OF ELECTROSTATIC ELECTRON ANALYZERS. PART 1: TOROIDAL ANALYZERS
O. Keski-Rahkonen and M. O. Krause (Oak Ridge Natl. Lab., Tenn.) 1977 12 p refs Sponsored in part by U.S. Energy Res. and Develop. Admin.
(Rept-3/1977-Pt-1; ISBN-951-750-986-3) Avail: NTIS HC A02/MF A01

Relativistic correction terms up to second order were derived for the kinetic energy of an electron traveling along the circular central trajectory of a toroidal analyzer. A practical energy calibration equation of the spherical sector plate analyzer was written for the variable-plate-voltage recording mode. Accurate measurements performed with kinetic energies from 600 to 2100 eV are in good agreement with this theory showing that the approximation (neglect of fringing fields, and source and detector geometry) is realistic enough for actual calibration purposes. Author (ESA)

N78-14287# Helsinki Univ. of Technology, Espoo (Finland). Lab. of Physics.
RELATIVISTIC EFFECTS IN THE CALIBRATION OF ELECTROSTATIC ELECTRON ANALYZERS. PART 2: PARALLEL PLATE AND CYLINDRICAL MIRROR ANALYZERS
O. Keski-Rahkonen 1977 17 p refs
(Rept-4/1977-Pt-2; ISBN-951-750-987-1) Avail: NTIS HC A02/MF A01

Relativistic correction terms up to second order were derived for the kinetic energy of an electron traveling along the central trajectory, which crosses the nonrelativistic foci of electrostatic parallel plate and cylindrical mirror analyzers. The effects of fringing fields and source geometry were neglected. In both cases the magnitude of relativistic corrections depends on the geometry of the analyzer, but generally it is smaller than for the toroidal family of analyzers. Author (ESA)

N78-14288# Technische Hochschule, Darmstadt (West Germany). Fachgebiet Elektroakustik.
ELECTROACOUSTIC ELECTRET DOUBLE-GRID TRANSDUCER WITH CROSSWISE ALTERNATING POTENTIAL OF THE GRID RODS [ELEKTROAKUSTISCHER ELEKTRET-DOPPELGITTER-WANDLER MIT KREUZWEISE ALTERNIERENDEM POTENTIAL DER GITTERSTAEBE]
Guenter Morgenstern Mar. 1977 29 p refs In GERMAN
(IND-FB-96) Avail: NTIS HC A03/MF A01

Numerical calculations were made of the force acting on an electret in an electret double-grid transducer with crosswise alternating potential of the grid rods and the capacitance per length of rod and per pair of rods for several dimensions. These parameters are needed for determining the two-port properties of an electroacoustic transducer using the electromechanical interaction in a similar grid rod configuration. ESA

N78-14289# Technische Hochschule, Darmstadt (West Germany). Fachgebiet Uebertragungstechnik.
A RECURSIVE TRANSFORMATION PRESCRIPTION FOR SYNTHESIS OF LINEAR ACTIVE RC NETWORKS [EINE REKURSIVE TRANSFORMATIONSVORSCHRIFT ZUR SYNTHESE LINEARER AKTIVER RC-NETZWERKE]
Heinz-Dieter Ferling Apr. 1977 19 p refs In GERMAN
(IND-FB-99) Avail: NTIS HC A02/MF A01

The process described uses a recursive transformation prescription for synthesis of linear RC circuits with voltage-controlled voltage sources as active elements. Its application is exemplified for a three-pole gyrator and a second order high pass filter. ESA

N78-14290# Technische Hochschule, Darmstadt (West Germany). Fachgebiet Uebertragungstechnik.
RECURSIVE CALCULATION OF CHARACTERISTIC EQUATIONS IN THE SYNTHESIS OF ACTIVE RC CIRCUITS [REKURSIVE BERECHNUNG CHARAKTERISTISCHER GLEICHUNGEN BEI DER SYNTHESE AKTIVER RC-SCHALTUNGEN]
Heinz-Dieter Ferling Jun. 1977 30 p refs In GERMAN
(IND-FB-101) Avail: NTIS HC A03/MF A01

It is shown that characteristic equations, in which the nonideal properties of the active components are accounted for, can be obtained stepwise during the synthesis of active RC networks, parallel to the synthesis process. This possibility provides the basis for deriving conditions for the synthesis of stable circuits. ESA

N78-14291# Danish Research Center for Applied Electronics, Hoersholm.
LARGE SCALE INTEGRATION (LSI). CONSIDERATION OF SOME OF THE ESSENTIAL PROBLEMS ENCOUNTERED BY THE DANISH ELECTRONICS INDUSTRY IN RELATION TO LSI TECHNOLOGY DEVELOPMENT [EN BELYSNING AF NOGLE AF DE PROBLEMER, DER ER VAESENTLIGE FOR DANSK ELEKTRONIKINDUSTRI I FORBINDELSE MED UDVIKLINGEN INDEN FOR LSI-TEKNOLOGIEN]
Soeren Larsen and S. T. Lesen Jun. 1977 53 p In DANISH; ENGLISH summary Sponsored by Akad. for de Tek. Videnskaber Report contains color illustrations
(ECR-72) Avail: NTIS HC A04/MF A01; Danish Res. Centre

for Appl. Electron, Hoesholm D.Kr. 50

Information concerning large scale integration (LSI) has been collected and is summarized. The possibility of establishing LSI activities in Denmark is discussed. ESA

N78-14292# Centre National d'Etudes Spatiales, Toulouse (France).

PHYSICO-CHEMICAL PROPERTIES AND APPLICATIONS OF 2-6 SEMICONDUCTORS [PROPRIETES PHYSICO-CHIMIQUES ET APPLICATIONS DES MATERIAUX SEMI-CONDUCTEURS 2-6]

Jean-Pierre Bouloumie Mar. 1977 231 p refs In FRENCH; ENGLISH summary

(CNES-NT-70) Avail: NTIS HC A11/MF A01

A bibliographical synthesis study relating to the physical and chemical properties of 2-6 semiconductors is followed by a list of their main applications: thermistors, Hall effect devices, magnetoresistive devices, diodes and transistors, electroluminescence and laser effect, piezoelectric transducers, and electroacoustic transducers. Author (ESA)

N78-14293# Electricity Council Research Center, Capenhurst (England).

A REVIEW OF THE FACTORS INFLUENCING ELECTROSTATIC SHOCKS IN OFFICES

G. W. Brundrett Apr. 1977 34 p refs

(ECRC/M1046) Avail: NTIS HC A03/MF A01

Electrostatic shocks are relatively rare in Britain. The key factor is the electrical resistance of the carpet which is a function of the material, the weave, and the relative humidity of the ambient air. Relative humidities above 40% or 55% when underfloor heating is used will prevent most shocks. Lower humidities can occur during cold spells in nonhumidified buildings which have air conditioning or mechanical ventilation. In this case the shocks will be more likely to occur in the large open plan offices when walking distances are large. Women are much more sensitive than men. Electrostatic sparks from people will not ignite dust clouds, but can ignite common flammable gases. Particular attention is needed in oxygen enriched atmospheres since a spark which would be unnoticed could ignite gases in such an atmosphere. Author (ESA)

N78-14294# National Bureau of Standards, Washington, D. C. Electronic Technology Div.

SEMICONDUCTOR MEASUREMENT TECHNOLOGY: SAFE OPERATING AREA LIMITS FOR POWER TRANSISTORS, VIDEOTAPE SCRIPT

David L. Blackburn Sep. 1977 20 p refs

(ARPA Order 2397)

(PB-272255/1; NBS-SP-400-44; LC-77-608172) Avail: NTIS HC A02/MF A01 CSCL 09A

Deficiencies of present methods for measuring and specifying the power dissipation capabilities and safe operating area (SOA) limits for power transistors result from not including adequately the effects of significant temperature nonuniformities which occur, primarily for high voltage, low-current conditions. Because of thermal instability and the hot spots that ensue, devices can operate with potentially dangerous hot spots within operating limits that traditionally have been considered to be safe. A method for detecting the onset of thermal instability and triggering a circuit to turn-off the transistor under test is described. GRA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N78-14295 Stanford Univ., Calif.

EVALUATION OF SUBGRID-SCALE TURBULENCE MODELS USING A FULLY SIMULATED TURBULENT FLOW Ph.D. Thesis

Robert Arthur Clark 1977 129 p

Avail: Univ. Microfilms Order No. 77-18203

Numerous models were proposed for approximating the subgrid scale Reynolds stresses in numerical simulations of turbulent fluid flow. An exact turbulent flow field on a three dimensional grid with 64 points on a side was calculated. The flow simulates grid-generated turbulence from wind tunnel experiments. In this simulation, the grid spacing was small enough to include essentially all of the viscous energy dissipation and the box was large enough to contain the largest eddy in the flow. The method was limited to low-turbulence Reynolds numbers. Dissert. Abstr.

N78-14296 Michigan Univ., Ann Arbor.

THE REVERSE STREAMING PHENOMENON, VOLUMES 1 AND 2 Ph.D. Thesis

Marvin Leonard Cadwell 1977 483 p

Avail: Univ. Microfilms Order No. 77-17962

An acoustic streaming flow phenomenon, hereafter called reverse streaming, is reported and investigated. The phenomenon was discovered during a study of ultrasonically enhanced mass transfer occuring at a gas-liquid interface. The reverse streaming phenomenon occurs in a system in which a high frequency ultrasonic transducer is positioned in a liquid with its radiating diaphragm parallel to the plane formed by a free (initially undisturbed) liquid surface. Upon insonation, a toroidal shaped, reverse streaming vortex is formed extending throughout the liquid between the free surface and the transducer. Flow along the centerline of the vortex is directed toward the transducer. With a sufficient increase in power input, this vortex shrinks and rises toward the liquid surface. Dissert. Abstr.

N78-14297 Michigan Univ., Ann Arbor.

SUPPRESSION AND AMPLIFICATION OF LEE WAVES Ph.D. Thesis

Donald William Lee 1977 95 p

Avail: Univ. Microfilms Order No. 77-18057

The suppression or amplification of lee waves created by steady flows of a fluid past a two-dimensional barrier, by means of a second barrier, is investigated. The method of singularities and the method of separation of variables are used to study both surface waves on a homogeneous fluid and internal waves in a density-stratified fluid. The determination of proper barrier spacing, barrier shape, and flow conditions is made so as to suppress or amplify waves created in the lee of the first barrier far downstream. Streamlines for each case are determined by computation. Dissert. Abstr.

N78-14298 State Univ. of New York, Stony Brook.

A STUDY OF THE HEAT TRANSPORT IN A GRID TURBULENCE Ph.D. Thesis

Kattalaicheri Srinivasan Venkataramani 1977 172 p

Avail: Univ. Microfilms Order No. 77-20030

Turbulent transport of heat in a wind tunnel in which the turbulence generating grid simultaneously imparts a mean temperature profile varying linearly with the vertical direction was studied. Apart from leading to an asymptotic decay of the temperature fluctuations, the molecular diffusivity distinguished the dispersion of heat from that of material particles. This latter aspect was examined by means of a new approach which involves the normal motion of isothermal (or isoconcentration) surfaces relative to the material elements. It is shown that this approach yields the exact results in both the limiting cases of pure turbulent diffusion and pure molecular diffusion. In qualitative agreement with other approaches for this problem, the total dispersion obtained with this method was less than the sum of the individual dispersions of the two diffusion processes. Dissert. Abstr.

N78-14299 Washington Univ., Seattle.

A RHEOLOGICAL INVESTIGATION OF THE MOVEMENT OF IMMERSED BODIES THROUGH SOLID-LIQUID SUSPENSIONS Ph.D. Thesis

Anirudh Kumar Bhasin 1977 164 p

Avail: Univ. Microfilms Order No. 77-18313

It is suggested that the solid concentration and particle size are the two important variables which affect the suspension behavior and the movement of immersed bodies through them. The effects of these two variables on the rheological characteristics

of the suspensions which follow a power-law viscosity model were studied. Using the dimensional analysis technique, empirical relationships between the power-law parameters and n and K and the suspension variables were developed. The values of n obtained from experimental data showed that suspensions became less Newtonian with increase in solid concentration and reduction in particle size. The power-law viscosity parameter K was found to be directly proportional to the solid concentration.
Dissert. Abstr.

N78-14300 Stanford Univ., Calif.
THE STUDY OF ENERGY, MASS, MOMENTUM TRANSFER AND SPRAY MEASUREMENT AT AN AIR-WATER INTERFACE Ph.D. Thesis
Chen Sheng Wang 1977 192 p
Avail: Univ. Microfilms Order No. 77-18258

The experimental program was undertaken in an attempt to obtain some quantitative information about the spray concentration and size distribution, as well as to determine what role the spray plays in the total energy and mass transfer processes. Five variations of wind speed conditions were employed. Energy and mass flux were determined by the integral method with velocity, humidity and thermal profile data taken by a pitot-static probe and thermistors. Four sets of spray data were obtained using an electrostatic capacitance-wire probe, 0.063 mm in diameter and 6 cm in length. The sensing wire is contained within a grounded, metal-wire helix which serves as an electrical shield but does not materially impede the flow carrying the aerosols. Also, measurements of the water surface characteristics were made by the use of a wave height gage. Dissert. Abstr.

N78-14301 Case Western Reserve Univ., Cleveland, Ohio.
HEAT TRANSFER CHARACTERISTICS OF POROUS MEDIA Ph.D. Thesis
Kau Fui Wong 1977 348 p
Avail: Univ. Microfilms Order No. 77-18853

The volume average energy conservation equations that apply within a porous medium are formulated. Interfacial radiation was included in the analysis. A general relationship has been derived between the effective thermal conductivities of the individual phases and the effective thermal conductivity of the saturated porous medium system. The volume average energy conservation equations predict thermal equilibrium to exist within a porous medium if there is thermal equilibrium at the system boundaries. It was shown that the internal heat transfer coefficient could be evaluated from experimental data. There is evidence that the heat transfer coefficient is a function of temperature boundary conditions. Experimental verification is cited for the three dimensional axisymmetric model under thermal equilibrium conditions. The use of the two temperature model in evaluating the thermal equilibrium assumption is also demonstrated.
Dissert. Abstr.

N78-14302 Cornell Univ., Ithaca, N. Y.
TURBULENT TRANSPORT IN A VERTICAL NATURAL CONVECTION BOUNDARY LAYER AND WITHIN AND ABOVE A MAIZE CANOPY Ph.D. Thesis
Robert George Bill, Jr. 1976 103 p
Avail: Univ. Microfilms Order No. 77-18882

Turbulent transport was measured by hot-wire techniques in two distinct types of flow: a natural convection boundary layer generated in the laboratory; and a canopy flow resulting from the interaction of a maize canopy with the atmospheric surface layer. Three calibrated hot-wire sensors and a thermocouple were used to measure the longitudinal and normal components of velocity, u and v, and the temperature, t, in the transition and turbulent flow regime of the buoyancy induced boundary layer adjacent to a constant heat flux vertical surface. Analog signals of the sensor were digitized and recorded on magnetic tape in real time. The digital data was processed using a Fast-Fourier transform type algorithm to calculate variances, covariances, correlation coefficients, and various spectra.
Dissert. Abstr.

N78-14303 Cornell Univ., Ithaca, N. Y.
AN EXPERIMENTAL STUDY OF A SELF-CONFINED FLOW WITH RING-VORTICITY DISTRIBUTION Ph.D. Thesis
Kon-Mang Lin 1976 163 p
Avail. Univ. Microfilms Order No. 77-18176

A form of self confined flow where a closed stream surface formed away from any solid boundary was investigated. An inviscid flow analysis indicated that in a purely meridional, axisymmetric flow, a stationary, spherical, self-confined region should occur in the center of a streamlined divergent-convergent enlargement zone if the vorticity distribution was simply proportional to the cylindrical radius throughout the whole field. The spherical confinement region was at rest and at constant pressure. Experimental examinations were carried out in a specially built test apparatus with room air as the medium. The streamlined divergent-convergent interior shape of the test section was fabricated according to the theoretical calculation for a particular streamline.
Dissert. Abstr.

N78-14304 Tulane Univ., New Orleans, La.
A VERTICAL ROUND JET CONFINED BY A VESSEL WITH OR WITHOUT HEAT TRANSFER Ph.D. Thesis
Moustafa Mohamed El-Sayed 1976 261 p
Avail: Univ. Microfilms Order No. 77-19497

A vertical circular jet confined to a dead end, vertical cylinder was studied. The jet generates recirculation of the type found in combustion chambers. Geometrical arrangement of flow patterns, temperature distribution and heat transfer were examined analytically and experimentally. The analytical study was carried out for the isothermal jet under both laminar and turbulent flow conditions. For the turbulent case a two equation turbulence model was used, which assumes the effective viscosity to be a function of the turbulent kinetic energy and its rate of dissipation. Both the turbulent kinetic energy and its rate of dissipation were determined by solving two transport equations simultaneously with equations governing the vorticity and the stream function. Solutions were carried out by using a finite difference technique, and the results for both laminar and turbulent flows were compared against the results.
Dissert. Abstr.

N78-14305 Vanderbilt Univ., Nashville, Tenn.
ANNULAR TURBULENT TWO-PHASE CONDENSING FLOW: A MIXING LENGTH APPROACH Ph.D. Thesis
Sheldon Wayne Mandel 1977 197 p
Avail: Univ. Microfilms Order No. 77-19385

The details of annular two phase condensing flows were studied and a reliable technique for calculating heat transfer and pressure drop performance was developed. Governing momentum, energy and continuity partial differential equations of viscous fluid flow as applied to the annular condensing flow model were solved using the mixing length approach for mathematical closure. By coupling proven single phase flow mixing length expressions with a model of the two phase interface, good agreement between experimental and analytical results was achieved over a range of fluid mass velocities from 230,000 to 680,000 lbm/hr sqft.
Dissert. Abstr.

N78-14306 California Univ., Los Angeles.
THREE-DIMENSIONAL SPATIAL STABILITY AND TRANSITION OF COMPRESSIBLE BOUNDARY LAYER FLOWS Ph.D. Thesis
Hutan Taghavi 1977 197 p
Avail: Univ. Microfilms Order No. 77-19647

The three dimensional spatial stability of compressible boundary layers on a flat plate was investigated, along with a way to predict the beginning of transition using the stability results. The disturbances were assumed to be small, and the mean flow was taken to be parallel yielding linear stability equations. The mean flow was obtained from the standard compressible boundary layer solution over a flat plate, assuming, perfect gas fluid properties, Sutherland's law of viscosity, and constant Prandtl number. The three dimensional disturbance equations were transformed to a coordinate normal to the wave front for simplification. The compressible mean flow solutions were used in the complete set of five stability equations. The stability equations were solved for spatial amplification of the disturbance.
Dissert. Abstr.

N78-14307 Tulane Univ., New Orleans, La.
ON THE MECHANICS OF RUPTURE ZONES IN THE GRAVITY FLOW OF A GRANULAR MATERIAL Ph.D. Thesis

John S. Templeton, III 1974 205 p
Avail: Univ. Microfilms Order No. 77-19509

The study was accomplished by means of the performance of an experiment on the plane mass flow of sand from a small hopper, the development of a continuum theory for the flow of a granular material in plane deformation, and an analysis of the mechanics of rupture zones in the plane mass-flow of sand from a hopper. The experiment employed radiography and high speed X-ray cinematography with simultaneous hopper wall pressure measurements in the vicinity of anticipated formation of rupture zones. The object of the experiment was to provide observations of significant aspects of the mechanics of mass flow generally and of the rupture zones in particular. The theoretical development included the derivation of important kinematical results for granular materials with rigid granules and the derivation of constitutive relations from the known behavioral properties of granular materials. Dissert. Abstr.

N78-14308 British Library Lending Div., Boston Spa (England).
SIMILITUDE PARAMETERS FOR FLOW MACHINES
O. Cordier 1977 16 p refs Transl. into ENGLISH from Brennst.-Waerme-Kraft (West Ger.), v. 5, no. 10, Oct. 1953 p 337-340
(BLL-ME/76/24) Avail: British Library Lending Div., Boston Spa, Engl.

A wide range of flow machines is evaluated by allocating dimensionless values for rotational speed and rotor diameter. Using this method, the interpretation of experimental results or proven calculated data provides a simple and reliable basis for new designs and modifications of flow machines. Author

N78-14309 Polish Academy of Sciences, Warsaw.
COUPLING OF DISSIPATIVE MECHANISMS OF VISCO-PLASTIC FLOW
Piotr Perzyna 5 Apr. 1977 36 p refs Presented at 14th IUTAM Congr., Delft, Netherlands, 30 Aug. - 4 Sep. 1976
Avail: Issuing Activity

Coupling effects between dissipative mechanisms of an elastic-viscoplastic material are described. A reasonable and physically justified theory of viscoplasticity was constructed within the framework of material structure with internal state variables. In particular the internal friction, the thermally activated and the high velocity dislocation damping mechanisms were considered. A discussion of coupling of dissipative effects for these mechanisms is given. Two groups of internal state variables are introduced. It was shown that the group of internal state variables describing dissipative effects of the internal friction mechanism can be eliminated. In this case, the evolution equations for plastic flow mechanism were modified in such a way that the influence of internal friction effects were taken into account. Author

N78-14310 British Library Lending Div., Boston Spa (England).
MAKING ALLOWANCE FOR THERMAL CAPACITY OF A HEAT SOURCE WHEN MEASURING THE COEFFICIENT OF THERMAL CONDUCTIVITY BY THE NON-STATIONARY METHOD
V. A. Tsymarnyj and N. F. Potienko 25 May 1977 7 p refs Transl. into ENGLISH from Inzh.-Fix. Zh. (USSR), no. 2291-74 7 p In RUSSIAN and ENGLISH
(BLL-NEL-TT-2726-(6075.461)) Avail: British Library Lending Div., Boston Spa, Engl.

An approximate method is presented for describing a temperature field, as determined by the action of an infinitely long and infinitely thin heat source of constant power, placed in a homogeneous medium at zero initial temperature. A correction required for the thermal capacity of the heat source is evaluated and the error due to using the approximation is excluded. J.M.S.

N78-14311# Southern Methodist Univ., Dallas, Tex. Dept. of Civil and Mechanical Engineering.
PREDICTION OF TURBULENT BOUNDARY LAYERS IN THE VICINITY OF SEPARATION
Roger L. Simpson and M. A. Collins 28 Jan. 1977 40 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in Apr. 1978
(Grant DAHC04-75-G-0051)
Avail: NTIS HC A03/MF A01

Several aspects of the prediction of separating two-dimensional incompressible turbulent boundary layers are considered. A turbulent boundary layer prediction program was modified to account for the normal stress terms in the momentum and the turbulence energy equations, which become important near separation. On the whole, predictions were improved up to the beginning of intermittent separation, or where backflow begins on an intermittent basis. A model was developed and used to predict the intermittent separation location based on the experimental observation that intermittent separation begins when the local turbulence intensity is first greater than one-third. Because the normal stresses appear to oppose the pressure gradient effect near separation, the basis for a pressure gradient modified law-of-the-wall mean velocity profile after intermittent separation is questionable. In predictions of test flows, the traditional and McDonald law-of-the-wall velocity profiles were used with only small differences in the results upstream of intermittent separation. Author

N78-14312# Southern Methodist Univ., Dallas, Tex. Dept. of Civil and Mechanical Engineering.
FLOWFIELD PREDICTION OF SEPARATING TURBULENT SHEAR LAYERS
Michael A. Collins and Roger L. Simpson 24 Jan. 1977 36 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in Apr. 1978
(Grant DAHC04-75-G-0051)
Avail: NTIS HC A03/MF A01

The prediction of a high Reynolds number incompressible mean two-dimensional turbulent shear flow that has separated due to an adverse pressure gradient is treated. It is argued that for a fully-stalled case the turbulent shear layer and the free-stream flow interact to produce pressure gradient relief downstream of the beginning of intermittent separation. Thus, the location of the displacement thickness and the velocity components at the outer edge of the separated shear layer can be calculated. Predictions for the flow are in fairly good agreement with experiment results. Having the velocity components at the outer separated shear flow edge, the separated flow can be computed inward to the wall. Because the backflow appears to only serve the main purpose of satisfying the continuity requirement, simple parabolic velocity and shearing stress models are used in the wall region in a downstream marching procedure. The results are good for the important boundary layer thickness and mean velocity profile predictions and fairly good for other quantities. Author

N78-14313*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL EVALUATION OF PREMIXING-PREVAPORIZING FUEL INJECTION CONCEPTS FOR A GAS TURBINE CATALYTIC COMBUSTOR
Robert Tacina Aug. 1977 19 p refs Presented at ASME Winter Ann. Meeting, Atlanta, 27 Nov. - 2 Dec. 1977
(Contract EC-77-A-31-1011)
(NASA-TM-73755; E-9301; CONS/1011-18) Avail: NTIS HC A02/MF A01 CSCL 20A

Experiments were performed to evolve and evaluate a premixing-prevaporizing fuel system to be used with a catalytic combustor for possible application in an automotive gas turbine. Spatial fuel distribution and degree of vaporization were measured using Jet A fuel. Three types of air blast injectors, an air assist nozzle and a simplex pressure atomizer were tested. Air swirlers with vane angles up to 30 deg were used to improve the spatial fuel distribution. The work was done in a 12-cm (4.75-in.) diameter tubular rig. Test conditions were: a pressure of 0.3 and 0.5 MPa (3 and 5 atm), inlet air temperatures up to 800 K (980 F), velocity of 20 m/sec (66 ft/sec) and fuel-air ratios of 0.01 and 0.025. Uniform spatial fuel distributions that were within plus or minus 10 percent of the mean were obtained. Complete vaporization of the fuel was achieved with air blast configurations at inlet air temperatures of 550 K (530 F) and higher. The total pressure loss was less than 0.5 percent for configurations without air swirlers and less than 1 percent for configurations with a 30 deg vane angle air swirler. Author

N78-14314*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SINGLE-NODE ORBIT ANALYSIS WITH RADIATION HEAT TRANSFER ONLY

Jerry A. Peoples Sep. 1977 35 p refs
(NASA-TM-78142) Avail: NTIS HC A03/MF A01 CSCL 20D

The steady-state temperature of a single node which dissipates energy by radiation only is discussed for a nontime varying thermal environment. Relationships are developed to illustrate how shields can be utilized to represent a louver system. A computer program is presented which can assess periodic temperature characteristics of a single node in a time varying thermal environment having energy dissipation by radiation only. The computer program performs thermal orbital analysis for five combinations of plate, shields, and louvers. Author

N78-14315*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

STANDARDIZATION OF COMPUTATIONAL EXPERIMENTS IN UNSTEADY TURBULENT BOUNDARY-LAYER FLOW

L. W. Carr Dec. 1977 15 p refs Prepared in cooperation with Army Aviation Res. and Develop. Command, Moffett Field, Calif.
(NASA-TM-78445; A-7230) Avail: NTIS HC A02/MF A01 CSCL 20D

Numerical experiments are proposed as standard cases to be computed by all who plan to analyze unsteady turbulent boundary layer behavior. In this way, differences between the results obtained by various methods can be compared in a completely defined environment. The test cases range in difficulty from time relaxation study of the steady flow on a flat plate to the analysis of unsteady reversed flow. Initial and boundary conditions are fully defined for each case and representative outputs are presented. It is recommended that tabulated samples of computations of these test cases be published in a compendium of results. Author

N78-14316# Advisory Group for Aerospace Research and Development, Paris (France).

LAMINAR-TURBULENT TRANSITION

Oct. 1977 380 p refs In ENGLISH and FRENCH Presented at the Fluid Dyn. Panel Symp., Lyngby, Denmark, 2-4 May 1977
(AGARD-CP-224; ISBN-92-835-0204-3) Avail: NTIS HC A17/MF A01

Stability theory and prediction methods applied to fluid dynamic processes in laminar-transitional flows are presented. For individual titles, see N78-14317 through N78-14344.

N78-14317*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

TRANSITION PREDICTION AND LINEAR STABILITY THEORY

Leslie M. Mack *In* AGARD Laminar-Turbulent Transition Oct. 1977 22 p refs (For availability see N78-14316 05-34)
(Contract NAS7-100)
Avail: NTIS HC A17/MF A01 CSCL 20D

Linear stability theory is used in computing the amplitude ratio for other than two-dimensional instability waves. The wave motion is obtained from the ray equations of kinematic wave theory, and the amplitude ratio by simply integrating the spatial amplification rate of the parallel flow theory along a ray. Both the temporal and spatial theories are examined for two- and three-dimensional incompressible and two-dimensional compressible boundary layers. The dispersion relation is most directly obtained with the temporal theory, but the magnitude and direction of the group velocity have to be computed to give the spatial amplification rate, and then only approximately. The spatial theory gives the spatial amplification rate directly, but only after the direction of the group velocity is known. Transition prediction methods, divided into amplitude-density and amplitude methods, are discussed. Author

N78-14318# National Maritime Inst., Teddington, (England).

SERIES REPRESENTATION OF THE EIGENVALUES OF THE ORR-SOMMERFELD EQUATION

M. Gaster *In* AGARD Laminar-Turbulent Transition Oct. 1977 12 p refs (For availability see N78-14316 05-34)
Avail: NTIS HC A17/MF A01

A series representation of the relation that links the eigenvalues of the Orr-Sommerfeld equation is developed. This enables the complex frequency parameter to be expressed as a double series in terms of the Reynolds number and wave number, both of which are treated as complex variables. The complex coefficients arising in this series are determined by contour integration for the case of the Blasius boundary layer profiles. A non-linear transformation is applied to the partial summations formed from the series in order to improve the convergence, and so to enable predictions of high accuracy to be made from only a few terms. Eigenvalues calculated by this technique are compared with those obtained directly from the Orr-Sommerfeld equation. The power of the technique is demonstrated by various graphical displays of the amplification contours for both temporal and spatial modes. Author

N78-14319# Stuttgart Univ. (West Germany). Inst. Fuer Aerodynamik und Gasdynamik.

FINITE AMPLITUDE STABILITY OF PLANE PARALLEL FLOWS

Thorwald Herbert *In* AGARD Laminar-Turbulent Transition Oct. 1977 10 p refs (For availability see N78-14316 05-34)
Avail: NTIS HC A17/MF A01

The equilibrium states of periodic finite amplitude motions in a plane channel are studied by a perturbation method for calculating the Landau constants, and by direct iterative solution of the differential equations resulting from Fourier decomposition of the secondary flow. According to a comparison of numerical results, the neglect of higher order terms in the amplitude restricts the use of the Landau method to almost neutral disturbances. The results of the iterative method indicate moderate convergence of the Fourier series. In all approximations, however, the equilibrium states form a connected neutral surface with a non-linear Reynolds number of about half the value obtained from the linearized theory. Some aspects of the secondary instability with respect to three-dimensional disturbances are discussed as well as the application of the iterative method to the combined Poiseuille-Couette flow and plane Couette flow. Author

N78-14320# Aerospace Corp., Los Angeles, Calif.

NUMERICAL INVESTIGATION OF NONLINEAR WAVE INTERACTION IN A TWO-DIMENSIONAL BOUNDARY LAYER

John W. Murdock and Thomas D. Taylor *In* AGARD Laminar-Turbulent Transition Oct. 1977 8 p refs Sponsored in part by ONR (For availability see N78-14316 05-34)
(Contract F04701-76-C-0077)
Avail: NTIS HC A17/MF A01

A spectral method is used to solve the unsteady, two-dimensional flow over a flat plate in the Reynolds number range of transition. The physical problem considered is the propagation of large amplitude (nonlinear) Tollmien-Schlichting waves in a boundary layer. The solutions are generally in qualitative agreement with nonlinear stability theories in that: (1) nonlinear effects can be destabilizing; (2) the growth/decay behavior of the primary mode is changed only slightly by nonlinear effects; and (3) the second temporal harmonic is usually a second spatial harmonic. There are, however, regions in the flow in which both (1) and (3) are not true. Details of the solution in such a region are given to illustrate the complex nonlinear wave interactions possible in a boundary layer. Author

N78-14321# Leeds Univ. (England). Dept. of Applied Mathematical Studies.

NONLINEAR INSTABILITY OF FREE SHEAR LAYERS

P. Huerre *In* AGARD Laminar-Turbulent Transition Oct. 1977 12 p refs In ENGLISH; FRENCH summary (For availability see N78-14316 05-34)
Avail: NTIS HC A17/MF A01

Nonlinear stability characteristics of a two dimensional free shear layer are determined for temporally growing waves of small amplification rate. The amplitude equation governing the growth of the disturbances is derived by making use of the method of multiple scales. It is then found that the finite amplitude response strongly depends on the nature of the flow in the critical layer. For low initial fluctuation levels, the critical layer is known to be viscous and nonlinear, and the wave amplitude ultimately reaches a saturation value, as described by the Stuart-Watson equation. For higher fluctuation levels however, the critical layer is purely nonlinear and the instability waves are amplitude

modulated so that no equilibrium value is ever reached. The initial amplification rate and mode shape are found to be very sensitive to the magnitude of the initial disturbance. Author

N78-14322*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
NONPARALLEL STABILITY OF BOUNDARY LAYERS WITH PRESSURE GRADIENTS AND SUCTION
William S. Saric and Ali Hasan Nayfeh *In* AGARD Laminar-Turbulent Transition Oct. 1977 21 p refs In ENGLISH; FRENCH summary (For availability see N78-14316 05-34)
(Grant NsG-1255)
Avail: NTIS HC A17/MF A01 CSCL 20D

An analysis is presented for the linear nonparallel stability of boundary layer flows with pressure gradients and suction. The effect of the boundary layer growth is included by using the method of multiple scales. The present analysis is compared with those of Bouthier and Gaster and the roles of the different definitions of the amplification rates are discussed. The results of these theories are compared with experimental data for the Blasius boundary layer. Calculations are presented for stability characteristics of boundary layers with pressure gradients and nonsimilar suction distributions. Author

N78-14323# California State Univ., Long Beach. Dept. of Mechanical Engineering.
STABILITY CALCULATIONS FOR A ROTATING DISK
Tuncer Cebeci and Herbert B. Keller (Calif. Inst. of Technol., Pasadena) *In* AGARD Laminar-Turbulent Transition Oct. 1977 9 p refs (For availability see N78-14316 05-34)
(Contract N00014-76-C-0927)
Avail: NTIS HC A17/MF A01

Solutions are obtained for the governing layer and stability equations for a rotating disk by using an efficient numerical method. The stability calculations utilize Stuart's J-profiles in the solution of the Orr-Sommerfeld equation and provide good agreement with Brown's numerical predictions of neutral stability curve. Preliminary calculations when applied to determine the number or vortices on a rotating disk agree reasonably well with experimental data and clearly demonstrate the expected improvements due to the inclusion of viscosity. Author

N78-14324# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.
THE STABILITY OF AXIAL FLOW BETWEEN CONCENTRIC CYLINDERS TO ASYMMETRIC DISTURBANCES
R. Mahadevan and G. M. Lilley *In* AGARD Laminar-Turbulent Transition Oct. 1977 10 p refs (For availability see N78-14316 05-34)
Avail: NTIS HC A17/MF A01

The linear hydrodynamic stability for the axial flow between concentric circular cylinders has been investigated for both axisymmetric and asymmetric disturbances superposed on the mean flow. A step-by-step integration procedure has been chosen to solve the linearized disturbance equations. The neutral stability curves in the vicinity of minimum critical Reynolds number are obtained for various radius ratios and for azimuthal wave numbers from 0 to 4. The results show that the axisymmetric mode does not give the lowest critical Reynolds number for all radius ratios and also indicates the importance of the first azimuthal mode (n = 1) for small radius ratios. Author

N78-14325# Case Western Reserve Univ., Cleveland, Ohio.
STABILITY OF HEATED LAMINAR BOUNDARY LAYERS IN WATER
A. J. Strazisar and E. Reshotko *In* AGARD Laminar-Turbulent Transition Oct. 1977 9 p refs Sponsored in part by ONR (For availability see N78-14316 05-34)
Avail: NTIS HC A17/MF A01

The stability of heated laminar boundary layers on a flat plate has been studied in a low turbulence water tunnel. The disturbances were introduced by a vibrating ribbon and measurements of the response were made using temperature compensated hot-film anemometry. Neutral stability and spatial growth characteristics measured for uniform wall temperatures up to 8 F above the free stream temperature show agreement with theoretically predicted trends. Disturbance growth rates and the band of amplified disturbance frequencies both decreased as wall heating was increased. Disturbance growth rates for step changes in wall temperature are minimal when the step is located approximately at the minimum critical point of the unheated plate. Author

N78-14326# Princeton Univ., N. J. Dept. of Aerospace and Mechanical Sciences.
INSTABILITY AND TRANSITION IN AXISYMMETRIC WAKES
F. R. Hama, L. F. Peterson, S. C. DelaVeaux, and D. R. Williams *In* AGARD Laminar-Turbulent Transition (date) 8 p refs Sponsored in part by NSF (For availability see N78-14316 05-34)
Avail: NTIS HC A17/MF A01

Axisymmetric wakes created by bodies of revolution of a varity of bluntness, at a fixed body-diameter Reynolds number of 3600, are studied. The first wake producing body is a streamlined model with a sharp trailing tip of NACA 0006 cross-sectional shape, on which no separation takes place, and the second is a prolate spheroid with an enclosed recirculation region, which nevertheless does not break away. The experiment is performed in a running water channel, the hot-film anemometry being the principal technique. In both cases the basic oscillation at the beginning of the wake is that of 1 Hz component. In the wake of the streamlined body, this component acquires a reasonable helical mode as the stability theory considers, and an ensuing 2 Hz component is amplified quickly and dominates the instability and final breakdown. Behind the blunt prolate spheroid, on the contrary, the 1 Hz component dominates. In both cases, the dominating mode of oscillation, i.e., the 2 Hz component in the former and the 1 Hz in the latter, is identified to be a heavily squashed helical mode, which may be regarded as merely a side-to-side oscillation, and appears to play a decisive role in the breakdown. Author

N78-14327# Stuttgart Univ. (West Germany). Inst. fuer Aerodynamik und Gasdynamik.
THE INCOMPRESSIBLE FLUID MOTION DOWNSTREAM OF TWO-DIMENSIONAL TOLLMIEN SCHLICHTING WAVES
Franz Xaver Wortmann *In* AGARD Laminar-Turbulent Transition Oct. 1977 8 p refs (For availability see N78-14316 05-34)
Avail: NTIS HC A17/MF A01

Detailed flow field measurements were made of the natural deformation of two-dimensional Tollein waves in a water tunnel. The waves were stimulated by a vibrating ribbon and amplified to ten to thirteen wave lengths. The spanwise position of the breakdown was not fixed by any roughness in the test section. The results indicate for the incipient transition a three dimensional structure composed by the basic flow and longitudinal counterrotating sheets of vorticity which are inclined downstream and overlap each other like roof shingles. Author

N78-14328# Centre d'Etudes et de Recherches, Toulouse (France).
EXPERIMENTAL ANALYSIS AND CALCULATION OF THE ONSET AND DEVELOPMENT OF THE BOUNDARY LAYER TRANSITION
Daniel Arnal, Jean-Claude Juillen, and Roger Michel *In* AGARD Laminar-Turbulent Transition Oct. 1977 18 p refs In FRENCH; ENGLISH summary (For availability see N78-14316 05-34)
Avail: NTIS HC A17/MF A01

Transition of an incompressible boundary layer, with zero pressure gradient and low free-stream turbulence, is studied. Mean velocity, turbulence and Reynolds shear stress profiles are presented. The development of the wave is clearly shown until the turbulent spots appear. The intermittency phenomenon is studied by conditional sampling of the hot-wire signal. The comparison with calculation results obtained by resolution of a set of transport equations shows a good agreement for the mean characteristics of the flow; discrepancies observed for the turbulent quantities evolution are due to the intermittency phenomenon. Author

N78-14329# Stuttgart Univ. (West Germany). Inst. A fuer Mechanik.
NUMERICAL SIMULATION STUDIES OF TRANSITION PHENOMENA IN INCOMPRESSIBLE, TWO-DIMENSIONAL FLOWS

H. Fasel, H. Bestek, and R. Schefenacker *In* AGARD Laminar-Turbulent Transition Oct. 1977 8 p refs (For availability see N78-14316 05-34)
Avail: NTIS HC A17/MF A01

Preliminary results of stability and transition studies are discussed which were obtained by employing an implicit finite difference method for the solution of the complete Navier-Stokes equation. The reaction of a flat plate boundary to periodic disturbances of finite amplitude is studied in order to gain insight into the nonlinear, two dimensional development of the transition process. In another effort the numerical model is applied to the investigation of stability and transition in plane Poiseuille flow with special consideration of nonlinear, spacewise disturbance amplification. The effects of a single roughness element (backward-facing step) on stability and transition in a boundary layer flow are also considered. Author

N78-14330# Aix-Marseilles Univ. (France). Inst. de Mecanique Statistique de la Turbulence.
SOME MEASUREMENTS IN THE TRANSITIONAL SUPERSONIC WAKE OF A TRANSVERSE CIRCULAR CYLINDER WITH EMPHASIS ON THE EFFECT OF EXTERNAL NOISE
H. Burnage and J. Gaviglio *In* AGARD Laminar-Turbulent Transition Oct. 1977 11 p refs In ENGLISH; FRENCH summary (For availability see N78-14316 05-34)
Avail: NTIS HC A17/MF A01

The transition of the wake of a circular cylindar at M = 2.3 has been investigated in a low turbulence wind tunnel in which the stagnation pressure can be varied. The influence of the noise radiated by the nozzle walls boundary layers has been observed, and two possible mechanisms of interaction between the wake and the sound field are proposed. One is a fluttering motion on the viscous laminar wake due to a random motion of the stagnation and separation lines of the cylinder, the other is a direct interaction between the sound field and the verticity and entropy gradients in the laminar wake which has been shown to generate vorticity fluctuations. Methods, based on the interpretation of the hot wire anemometer signal, are proposed and justified to locate the statistical mean position of an initial, intermediate and final stage of transition, for a given Reynolds number. Author

N78-14331# University of Southern Calif., Los Angeles. Dept. of Aerospace Engineering.
THE COUPLING BETWEEN FREESTREAM DISTURBANCES, DRIVER OSCILLATIONS, FORCED OSCILLATIONS, AND STABILITY WAVES IN A SPATIAL ANALYSIS OF A BOUNDARY LAYER
Harold L. Rogler *In* AGARD. Laminar-Turbulence Transition Oct. 1977 15 p (For availability see N78-14316 05-34)
(Grants AF-AFOSR-3094-76; AF-AFOSR-2577-74)
Avail: NTIS HC A17/MF A01

Freestream disturbances are represented by arrays of rectangular vortices, oscillating sheets of vorticity, and irrotational fluctuations which propagate along with various speeds and wavenumbers. These disturbances interact inviscidly with a boundary layer which is represented by two layers of uniform vorticity and which has the same derivative of the mean velocity at the wall, the same displacement thickness, and the same momentum thickness as a Blasius layer. This layer begins at the leading edge and extends downstream with uniform thickness; upstream of the leading edge, the mean flow is uniform. Vorticity fluctuations convecting into the layer have their wavenumber increased, phase speed decreased, position above the wall increased, and frequency unchanged. Additional fluctuations then arise because the vorticity of the boundary layer is rearranged by the unsteady convection. Three fluctuations are found inside the boundary layer: (1) the driver oscillations which are the freestream disturbances modified by the shearing flow and/or the wall; (2) the forced oscillations with the same wavenumbers and phase speeds as the driver; and (3) the natural oscillations or eigenmodes with wavenumbers and phase speeds generally different from, but frequency the same as, the driver. Author

N78-14332# Centre d'Etudes et de Recherches, Toulouse (France).
TRANSITION OF A BOUNDARY LAYER SUBJECTED TO AN OSCILLATION OF THE EXTERNAL FLOW
Jean Cousteix, Robert Houdeville, and Ardre Desopper *In* AGARD Laminar-Turbulent Transition Oct. 1977 12 p refs In FRENCH; ENGLISH summary (For availability see N78-14316 05-34)
Avail: NTIS HC A17/MF A01

Laminar-turbulent transition of an oscillating boundary layer at 37 Hz is studied. The successive stages of the transition are experimentally studied by measurements of turbulent kinetic energy and of turbulent shear stress. Control of the intermittency phenomenon by the frequency of the external flow was observed. Onset and development of waves disturbing the laminar regime were followed by the formation of turbulent patches which are first localized and which occupy the whole cycle further downstream. Author

N78-14333# Laboratoire d'Aerothermique du C.N.R.S., Meudon (France).
THE INFLUENCE OF A PERIODIC WALL DEFORMATION ON THE DEVELOPMENT OF NATURAL INSTABILITIES LEADING TO A TRANSITION [INFLUENCE D'UNE DEFORMATION PERIODIQUE DE PAROI SUR LE DEVELOPMENT DES INSTABILITES NATURELLES CONDUISANT A LA TRANSITION]
Pierre Gougat and Francoise Martin *In* AGARD Laminar-Turbulent Transition Oct. 1977 9 p refs In FRENCH (For availability see N78-14316 05-34)
Avail: NTIS HC A17/MF A01

The natural instabilities which occur in the laminar boundary layer of a deformable wall are constituted by a series of intermittent waves. A spectral analysis of these fluctuations reveals the frequencies and coefficients of amplifications of natural instabilities are identical to those predicted by the stability theory. A deformation of the wall does not change the structure of the phenomena; it merely introduces a degree of exterior velocity which provokes an amplification or attenuation of the instabilities. The effect of a static deformation of the wall on the formation and amplification of boundary layer instabilities was studied in relation to the gradient of exterior speed. Transl. by A.R.H.

N78-14334# California Univ., Los Angeles.
THE EFFECT OF WALL HEATING UPON TRANSITION IN WATER BOUNDARY LAYERS
Steven J. Barker and Carl Jennings (Autonetics, Anaheim, Calif.) *In* AGARD Laminar-Turbulent Transition Oct. 1977 9 p refs Sponsored in part by DARPA Prepared in cooperation with Poseiden Research, Los Angeles, Calif. (For availability see N78-14316 05-34)
Avail: NTIS HC A17/MF A01

The stabilization of water boundary layers by wall heating is considered. Linear stability theory coupled with the e to the ninth transition criterion has predicted transition Reynolds numbers of greater than 200 million for a flat plate boundary layer over a heated wall. The boundary layer develops on the inside of a cylindrical tube 10.2 cm in diameter and 6.1 m in length. Heat is applied to the tube by electrical heaters on the outside wall. The location of transition is determined by local heat flux measurements or by a hot film anemometer at the downstream end of the tube. With no wall heat, a transition Reynolds number of 10 million was obtained in the tube boundary layer. As heat is added to the wall, the experimental results agree well with the theory up to a 10 F overheat. At higher overheats the measured transition Reynolds numbers are well below the predictions. The highest transition Reynolds number obtained was 42 million at an overheat of 35 F. Author

N78-14335# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
TRANSITION, PRESSURE GRADIENT, SUCTION, SEPARATION AND STABILITY THEORY
J. L. Vaningen *In* AGARD Laminar-Turbulent Transition Oct. 1977 15 p refs (For availability see N78-14316 05-34)
Avail: NTIS HC A17/MF A01

A semi-empirical method is presented for the prediction of transition in two-dimensional incompressible flows with pressure gradient and suction. Included is the case of the laminar separation bubble, where transition is preceded by laminar separation. The method employs linear stability theory to calculate the amplification factor sigma for unstable disturbances in the laminar boundary layer (sigma is defined as the natural logarithm of the ratio between the amplitude of a disturbance at a given instant or

position to the amplitude at neutral stability). It is found that at the experimentally determined transition position the calculated amplification factor for the critical disturbances attains nearly the same value (about 10) in many different cases for flows with low free stream turbulence levels. An attempt is made to include the effects of higher free stream turbulence levels by allowing the critical amplification factor to decrease with increasing free stream turbulence. Author

N78-14336# Cranfield Inst. of Technology (England). Aerodynamics Div.

LEADING EDGE TRANSITION ON SWEPT WINGS

D. I. A. Poll *In* AGARD Laminar-Turbulent Transition Oct. 1977 11 p refs (For availability see N78-14316 05-34)

Avail: NTIS HC A17/MF A01

The behavior of the swept wing attachment line boundary layer has been studied experimentally. Two dimensional trip wires and turbulent flat plate boundary layers have been used as sources of disturbance and a wide range of conditions has been covered, ensuring that the results are directly applicable to full scale flight situations. Simple criteria have been deduced and those allow the state of the attachment line boundary layer to be determined for a given geometry and free stream conditions. The validity of some of the principal results has been extended to high Mach numbers for the adiabatic wall case. Sample calculations show that most of the present generation of civil aircraft have turbulent attachment lines in the cruise condition. Although some benefit may be gained by a removal of root disturbances and the maintenance of a smooth leading edge the tolerable roughness heights are so small that it seems unlikely that turbulence can be prevented without some form of boundary layer suction. Author

N78-14337# Rolls-Royce Ltd., Derby (England). Dept. of Turbine Aerodynamics and Blade Cooling Research.

ENGINEERING PREDICTIONS OF TRANSITIONAL BOUNDARY LAYERS

A. E. Forest *In* AGARD Laminar-Turbulent Transition Oct. 1977 19 p refs (For availability see N78-14316 05-34)

Avail: NTIS HC A17/MF A01

A procedure is described for the prediction of transitional boundary layers occurring, for example, on turbomachinery blading. The method attempts to combine rapidity with the inclusion of the dominant influences affecting these flows. In consequence, a highly empirical approach has to be adopted. Some of the relationships employed are preliminary and schematic; nevertheless fair agreement with a range of data is obtained. The complexity of the flow conditions on a modern gas turbine rotor blade is demonstrated. Author

N78-14338# Physical Sciences, Inc., Woburn, Mass.

ON THE APPLICATION OF SECOND-ORDER CLOSURE MODELS TO BOUNDARY LAYER TRANSITION

Michael L. Finson *In* AGARD Laminar-Turbulent Transition Oct. 1977 6 p refs (For availability see N78-14316 05-34) (Contract F44620-74-C-0022)

Avail: NTIS HC A17/MF A01

Second-order closure models offer several potential advantages for the study and prediction of boundary layer transition. The required closure approximations can be formulated to represent an adequate physical description of the transition process. A five equation model is presented for fluctuating variables. It is argued that adequate closure techniques are available for the production, dissipation, and diffusion terms. Improved closure schemes are suggested, and a model is also presented for the manner by which surface roughness elements disturb the boundary layer. Calculations have been obtained for two by-pass situations where the initial fluctuation levels are relatively high, due either to free stream turbulence or surface roughness, and the results are in reasonable agreement with wind tunnel observations on flat plates. Author

N78-14339# Ecole Centrale de Lyon, Ecully (France).

A METHOD FOR PREDICTING BOUNDARY LAYER TRANSITION [METHODE DE PREDICTION DE LA TRANSITION DE LA COUCHE LIMITE]

C. Mari and J. Mathieu *In* AGARD Laminar-Turbulent Transition Oct. 1977 9 p refs In FRENCH; ENGLISH summary (For availability see N78-14316 05-34)

Avail: NTIS HC A17/MF A01

The method is based on recent works by McDonald about the transition in the boundary layer. In addition to momentum and total enthalpy equations, an integral equation for turbulent kinetic energy is taken into account. The numerical scheme is based in a semi-linear implicit method due to Patankar Spalding on the first hand, and on an iterative approach on the other hand. This choice was mostly quided by the short computing time used (5 to 6 sec. on CDC 7600). Author

N78-14340# ARO, Inc., Arnold Air Force Station, Tenn. Propulsion Wind Tunnel Facility.

A SURVEY OF TRANSITION RESEARCH AT AEDC

Jack D. Whitfield and N. Sam Dougherty, Jr. *In* AGARD Laminar-Turbulent Transition Oct. 1977 20 p refs Sponsored by AEDC (For availability see N78-14316 05-34)

Avail: NTIS HC A17/MF A01

Experimental research on transition Reynolds numbers conducted in a large number of ground test facilities is surveyed. Facilities surveyed included primary wind tunnels used for aerodynamic testing at subsonic, transonic, supersonic, and hypersonic conditions. Measurements have been made on cones and planar bodies, flat plates and hollow cylinders. The primary motivation for this research spanning nearly 25 years has been to verify the adequacy of the facilities to simulate flight conditions. This necessarily entailed the study of free stream disturbances in wind tunnels and the role these disturbances play in altering transition Reynolds number which must be considered when scaling Reynolds number sensitive data. Author

N78-14341# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Stroemungsmechanik.

AN EXPERIMENTAL STUDY OF BOUNDARY LAYER TRANSITION ON A SLENDER CONE AT MACH 5

P. Krogmann *In* AGARD Laminar-Turbulent Transition Oct. 1977 12 p refs (For availability see N78-14316 05-34)

Avail: NTIS HC A17/MF A01

Experimental results of an investigation conducted in a Ludwieg tube wind tunnel are presented. Transition was detected by means of local heat transfer rate measurements, and transition behavior on a 5 deg half-angle cone was investigated for different unit Reynolds numbers, temperature ratios and different angles of attack. In a range of unit Reynolds numbers from U/v = 100,000 to 5 x 100,000 transition Reynolds numbers were independent of unit Reynolds number. A variation of the wall to stagnation temperature ratio had no effect on transition. Small variations of angle of attack strongly affected transition, such that transition was promoted on the leeward surface and delayed on the windward surface. Author

N78-14342# Institut de Mecanique des Fluides de Marseille (France).

THREE-DIMENSIONAL BOUNDARY LAYER TRANSITION ON A YAWED 7.5 DEG SHARP CONE AT MACH 5

Annie Korsia and Jacques F. Marcillat *In* AGARD Laminar-Turbulent Transition Oct. 1977 10 p refs Sponsored by ONERA (For availability see N78-14316 05-34)

Avail: NTIS HC A17/MF A01

Boundary layer surveys and limiting streamlines at the wall pattern have been used for transition detection. Some examples of results obtained around a 7.5 deg sharp cone placed at angle of attack in a supersonic stream (M = 5) are presented. A simple new method of transition detection is reported that is based on the use of limiting streamlines at wall visualizations and that gives the picture of the boundary layer including the transition development from iso-Mach number contours. Author

N78-14343*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

PROGRESS IN THE DEVELOPMENT OF A MACH 5 QUIET TUNNEL

I. E. Beckwith, J. B. Andere, P. C. Stainback, W. D. Harvey, and A. J. Srokowski *In* AGARD Laminar-Turbulent Transition Oct. 1977 14 p refs (For availability see N78-14316 05-34)

Avail: NTIS HC A17/MF A01 CSCL 20D

Various techniques to control and reduce radiated noise and

the application of these techniques to a 1/2-water Mach 5 quiet tunnel are reviewed. Measurements in a small scale nozzle have shown that the upstream part of the supersonic wall boundary layer could be maintained laminar up to Reynolds numbers of nearly 4 x 1 million based on the test region length upstream of the nozzle exit. Turbulent noise levels in this test region were then reduced by an order of magnitude. To maintain low noise levels at higher Reynolds numbers, laminar flow noise shields are required. Data are presented for shields that consist of small diameter rods alined nearly parallel to the entrance flow with small gaps between the rods for boundary layer suction. Analysis and data presented on the noise shielding and reflection characteristics of flat plates and a rod-wall test panel indicate that freestream turbulent noise can be reduced by 70 to 90 deg at high Reynolds numbers. Performance estimates for the 1/2-meter tunnel are based on these results. Author

N78-14344# National Research Council of Canada, Ottawa (Ontario).

NON-OBTRUSIVE DETECTION OF TRANSITION REGION USING AN INFRA-RED CAMERA

David J. Peake, Arthur J. Bowker, Stephen J. Lockyear, and Freda. Ellis *In* AGARD Laminar-Turbulent Transition Oct. 1977 17 p refs (For availability see N78-14316 05-34)

Avail: NTIS HC A17/MF A01

A Mach 3.85, high Reynolds Number flow in a 5 x 5-inch blowdown wind tunnel was used to determine the region of natural transition on a flat model, by recording the infrared emission from the plate surface. The respective chord and span dimensions of the plate were 7.5 and 5.0 inches, and a bakelite insulator was incorporated as the test surface. The tests were conducted with an airfoil stagnation temperature close to atmospheric (33 C.). The recovery temperatures at the plate surface thus derived from the infra-red camera measurements, for the case of negligible heat transfer and pressure gradient, defined the extent of transition. The more conventional transition diagnostic techniques utilizing sublimation patterns, a surface pitot tube and surface hot-film gauges, supported the infrared measurements. Author

N78-14345# Lockheed Missiles and Space Co., Palo Alto, Calif.

ON THE COMPUTATION OF THE STEADY RADIAL DISTRIBUTION OF FINELY DISPERSED PARTICLES IN A VERTICAL TURBULENT GAS FLOW

Z. R. Gorbis, F. E. Spokoinyi, and R. V. Zagainova 1977 8 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (USSR), v. 32, no. 6, 1977 p 965-971

Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

A methodology and results of computing the radial concentration distributions of solid particles suspended in an axisymmetric stabilized turbulent stream were considered for different kinds of particle stream interaction with channel walls. Author

N78-14346*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.

THE SRB HEAT SHIELD: AEROELASTIC STABILITY DURING REENTRY

C. S. Ventres and E. H. Dowell Sep. 1977 88 p refs

(Contract NAS8-32171)

(NASA-CR-150479; BBN-3532) Avail: NTIS HC A05/MF A01 CSCL 20D

Wind tunnel tests of a 3% scale model of the aft portion of the SRB equipped with partially scaled heat shields were conducted for the purpose of measuring fluctuating pressure levels in the aft skirt region. During these tests, the heat shields were observed to oscillate violently, the oscillations in some instances causing the heat shields to fail. High speed films taken during the tests reveal a regular pattern of waves in the fabric starting near the flow stagnation point and progressing around both sides of the annulus. The amplitude of the waves was too great, and their pattern too regular, for them to be attributed to the fluctuating pressure levels measured during the tests. The cause of the oscillations observed in the model heat shields, and whether or not similar oscillations will occur in the full scale SRB heat shield during reentry were investigated. Suggestions for modifying the heat shield so as to avoid the oscillations are provided, and recommendations are made for a program of vibration and wind tunnel tests of reduced-scale aeroelastic models of the heat shield. Author

N78-14347# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

MOVEMENT OF A TILTED WING NEAR A SCREEN

V. G. Belinskiy 7 Feb. 1977 17 p Transl. into ENGLISH from Gidrodinamika Bolshikh Skorostey (USSR), no. 4, 1968 p 84-90

(AD-A045920; FTD-ID(RS)I-0040-77) Avail: NTIS HC A02/MF A01 CSCL 20/4

Movement of a tilted wing under a free surface of liquid, and the movement of a tilted wing with optimum circulation distribution have been studied. The present work presents the results of the study of the effect of a screen on the hydrodynamic characteristics of a tilted wing. An examination is made of the linear problem of stable movement at a rate V sub zero and with an angle of attack alpha of a thin airfoil tilted at an angle beta to a plane solid screen. The problem was solved using the method of the potential of acceleration. GRA

N78-14348# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

MOVEMENT OF A WING WITH A SMALL ASPECT RATIO NEAR THE INTERFACE OF FLUIDS WITH DIFFERENT DENSITIES

S. I. Putilin 31 Jan. 1977 12 p refs Transl. into ENGLISH from Gidroaerodinam. Nesushchikh Poverkhn. (USSR), 1966 p 61-68

(AD-A045921; FTD-ID(RS)I-0042-77) Avail: NTIS HC A02/MF A01 CSCL 20/4

The problem of the movement of a wing with a small aspect ratio below a free fluid surface has been studied. The integral equation for a wing with a small aspect ratio moving above the interface of fluids with different densities was obtained in a similar manner. But these studies did not determine the distribution of the load over the wing chord. This report will solve the problem which makes it possible to find the load distribution over the wing chord when condition lambda F r squared approaches zero, is satisfied, the Froude number being calculated for the wing span. GRA

N78-14349# Colorado State Univ., Fort Collins.

AN EXPERIMENTAL AND THEORETICAL INVESTIGATION OF THE MAGNETIZATION PROPERTIES AND BASIC ELECTROMECHANICS OF FERROFLUIDS Final Report

T. B. Jones and D. A. Krueger Sep. 1977 51 p refs

(Contracts N00014-67-A-0299-0020; N00014-76-C-0250)

(AD-A046060) Avail: NTIS HC A04/MF A01 CSCL 20/3

Ferrofluids are stable colloidal suspensions of sub-domain sized ferrite particles dispersed in a liquid medium by a suitable surfactant agent. Ferrofluids have been successfully prepared using water, hydrocarbons, esters, diesters, fluorocarbons, and even liquid mercury. Two applications showing considerable promise are ferrofluid rotary shaft seals and scrap metal separators. Rotary shaft seals have been commercially available for several years. Basic research on the magnetization properties and the bulk response of ferrofluids to magnetic fields has been conducted to meet the needs of the developing technology of ferrofluids. From the fluid mechanical point of view, ferrofluids are novel because they can interact with a magnetic field to produce a controllable body force on the fluid, a body force significant with respect to terrestrial gravity. From the basic physical point of view, ferrofluids are interesting because of the mechanisms which are involved in the transformation of the forces on individual ferrite particles to the bulk of the liquid carrier. The research program was divided into studies of the magnetization properties, and the electromechanics and applications. GRA

N78-14350# Brookhaven National Lab., Upton, N. Y.

PRESSURE-DROP FLUID-FLOW CORRELATION FOR FIXED BEDS OF SMALL, IRREGULARLY SHAPED PARTICLES

M. J. Rosso, Jr., G. Strickland, and J. S. Milau Nov. 1976 31 p refs

(Contract EY-76-C-02-0016)

(BNL-50589) Avail: NTIS HC A03/MF A01

An equation, derived from experimental data, was developed to describe the pressure-drop-flow relationship in fixed

beds of small, irregularly shaped particles. Within test limits the calculated and measured values agreed within 6 percent. All experimental runs were made with beds of particles with an average particle diameter ranging from 4.8 to 45 microns and varying hydrogen flow rates. With one exception the bed material was deactivated FeTi hydride or unhydrided FeTi alloy; one run was made with SiC powder, which has approximately the same particle shape and surface characteristics as FeTi. The pressure-drop data were used in the design of a hydride reservoir to determine the spacing of porous-metal tubes which serve as particle-barrier filters in the bed. ERA

N78-14351# Knolls Atomic Power Lab., Schenectady, N. Y.
ISOJACOBIC HYBRID DIFFERENCING OF THE NAVIER-STOKES EQUATION
Eugene L. Wachspress Jan. 1977 24 p refs Presented at Conf. on Numerical Analysis, Dundee, Great Britain, 28 Jun. 1977
(Contract EY-76-C-12-0052)
(KAPL-P-4055; Conf-770636-2) Avail: NTIS HC A02/MF A01

A generalization of the rectangular geometry used in TEACH to four-sided isoparametric elements similar to those used in finite-element structural computation is developed. Elements are constructed with the aid of a special isoparametric transformation. Since the Jacobian of the transformation is constant along certain lines, the interpolation is referred to as isojacobic. A new two-dimensional hybrid differencing procedure is devised. Interpolation formulas are derived for the steady state Navier-Stokes equation. ERA

N78-14352# Massachusetts Inst. of Tech., Oak Ridge, Tenn. School of Chemical Engineering Practice.
MODELING OF HEAT TRANSFER BETWEEN AN ICE-WATER STORAGE RESERVOIR AND ITS SURROUNDINGS
S. R. Wilson, H. F. Quarls, and R. G. Markeloff 23 Apr. 1975 75 p refs
(Contract W-7405-eng-26)
(ORNL/MIT-211) Avail: NTIS HC A04/MF A01

Heat transfer between in ice-water storage reservoir and its surroundings was examined. Numerical solutions were obtained for various steady states using a computer program, HEATING4. Analytical solutions for the transient side, bottom, and top of the reservoir were obtained after several major simplifying assumptions were made. From the numerical solutions, the effects of ambient air temperature and proximity of water surface to reservoir support beams and insulation on heat transfer were ascertained. ERA

N78-14353# Argonne National Lab., Ill.
SPLITTING METHOD FOR COMPUTING COUPLED HYDRODYNAMIC AND STRUCTURAL RESPONSE
J. E. Ash 1977 21 p refs Presented at Intern. Symp. on Innovative Numerical Analysis in Applied Engr. Sci., Paris, 23 May 1977
(Contract W-31-109-eng-38)
(CONF-770533-1) Avail: NTIS HC A02/MF A01

A numerical method was developed for application to unsteady fluid dynamics problems, in particular, to the mechanics following a sudden release of high energy. Solution of the initial compressible flow phase provided input to a power series method for the incompressible fluid motions. The system was split into spatial and time domains leading to the convergent computation of a sequence of elliptic equations. Two sample problems were solved, the first involving an underwater explosion and the second the response of a nuclear reactor containment shell structure to a hypothetical core accident. The solutions were correlated with experimental data. ERA

N78-14354# Carnegie-Mellon Univ., Pittsburgh, Pa.
STUDIES OF BIOFOULING IN OCEAN THERMAL ENERGY CONVERSION PLANTS
J. G. Fetkovich, G. N. Grannemann, L. M. Mahalingam, D. L. Meier, and F. C. Munchmeyer 1977 13 p refs Presented at 77th STAR Symp., San Francisco, 25 May 1977
(Contract EY-76-S-02-4041)
(COO-4041-4; Conf-770514-1) Avail: NTIS HC A02/MF A01

Efforts to extract energy from the ocean's thermal gradients by means of closed-cycle ocean thermal energy conversion plants with very large heat exchangers are considered. The effect of fouling on the heat transfer coefficient and the effectiveness of several means of biofouling prevention are discussed. ERA

N78-14355# Central Technical Inst. TNO, Apeldoorn (Netherlands).
THE HEAT TECHNICAL BEHAVIOR OF FLAME OVEN CHAMBER FLOORS [HET WARMTETECHNISCHE GEDRAG VAN VLOEREN VAN VLAMOVENKAMERS]
P. Nievergeld and M. Verwoerd Feb. 1976 17 p In DUTCH Sponsored by Stichting Tech. Centrum voor de Grofkeram. Ind.
(CTI-76-01615) Avail: NTIS HC A02/MF A01

A comparative investigation into the heat technical behavior of three different floor constructions of flame oven chambers was made. The quasi stationary temperature profile was calculated for each floor at a given heating curve, using the finite element method based BERTEM computer program. It was found that the three floors show only small differences in heat accumulation and heat transmission. The cyclic temperature fluctuations are no longer present at a depth of 1 to 1.5 m below the surface. During the first 30 hours after circular heating the floors transmit heat to the oven atmosphere. ESA

N78-14356# Central Technical Inst. TNO, Apeldoorn (Netherlands).
MEASUREMENTS AND CALCULATIONS OF AIR AND TEMPERATURE DISTRIBUTIONS IN A SIMPLE STACKED BOX SYSTEM [METINGEN EN BEREKENINGEN VAN LUCHT- EN TEMPERATUURVERDELINGEN IN EEN EENVOUDIGE DOZENSTAPELING]
P. J. Verhoef and M. Verwoerd 19 Mar. 1976 23 p refs In DUTCH
(CTI-76-02729) Avail: NTIS HC A02/MF A01

Measurements and calculations were performed on a system of ventilated stacked boxes in the framework of a climate control research project. The measurements served to verify the calculations, which were carried out using the Bertem computer program, a program for the calculation of stationary or nonstationary temperature distributions for one, two, or three-dimensional body configurations. There is good agreement between the measured and the calculated results. ESA

N78-14357# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abt. Experimentelle Aerodynamik.
INVESTIGATIONS OF A HIGHLY LOADED COMPRESSOR CASCADE WITH CONTROL OF THE BLADE BOUNDARY LAYER. PART 4: EXPERIMENTAL DETERMINATION OF THE BOUNDARY LAYER PARAMETERS FOR INCOMPRESSIBLE FLOW [UNTERSUCHUNGEN AN EINEM HOCHBELASTETEN VERDICHTERGITTER MIT BEEINFLUSSUNG DER SCHAUFELGRENZSCHICHT. TEIL 4: EXPERIMENTELLE ERMITTLUNG DER GRENSCHICHTGROESSEN BEI INKOMPRESSIBLER STROEMUNG]
R. Kiock Apr. 1977 84 p refs In GERMAN Prepared jointly with Motoren- u. Turbinen-Union Muenchen GmbH Sponsored by Bundesmin. fuer Verteidigung
(DLR-IB-151-77/5) Avail: NTIS HC A05/MF A01

Pressure distribution and boundary layer measurement were carried out on a plane, highly loaded compressor cascade V 100, to obtain further data for theoretical treatment of the boundary layer control problem of such cascades. Boundary layer measurements in several planes directly behind the discharge point were of particular interest. The angle of incident flow was varied within the range of separation at suction side. Tests were carried out with incompressible flow and at Reynolds number Re = 3 x to the 5th power in the high speed cascade wind tunnel. Several separation criteria were compared during evaluation. ESA

N78-14358# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
CONICAL STREAMLINES AND PRESSURE DISTRIBUTION IN THE VICINITY OF CONICAL STAGNATION POINTS IN ISENTROPIC FLOW
P. G. Bakker Apr. 1977 40 p refs
(VTH-LR-244) Avail: NTIS HC A03/MF A01

The properties of the supersonic flow in the vicinity of conical stagnation points, occurring in isentropic conical flow, were studied in a general way. The relation between conical streamline pattern and pressure distribution is discussed in detail. From this viewpoint some unsatisfactory results, occurring in literature, could be clarified. To obtain a unique description of local flow pattern a parameter is introduced which takes into account the particular properties of the pressure distribution.
Author (ESA)

N78-14359# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Dynamik Verduennter Gase.
DRAG AND HEAT TRANSFER MEASUREMENTS OF SHARP CONES AT DIFFERENT WALL TEMPERATURES IN THE TRANSITION AND FREE MOLECULAR FLOW REGIME
Hubert Legge 28 Mar. 1977 24 p refs
(DLR-FB-77-13) Avail: NTIS HC A02/MF A01; DFVLR, Cologne DM 14

The drag, heat transfer, and recovery temperature of cones at zero angle of attack were measured in the transition regime up to free molecular flow for 15, 30, 45, 60, (90) degree cone half angles. In free molecular flow air, argon, and helium were used. Whereas air and argon exhibit complete accommodation on the technical surfaces, helium shows a different behavior concerning the drag as well as the heat transfer results. The drag in the transition regime was studied especially as function of the wall temperature with nitrogen as test gas. In the whole examined Knudsen number and wall to stagnation temperature ranges the reduced drag coefficient is nearly independent of the wall temperature. Drag and the heat transfer data are compared with some theories and other experiments. Author (ESA)

N78-14360# Bristol Univ. (England). Dept. of Aeronautical Engineering.
THE FLOW IN AN OBSTRUCTED T-JUNCTION B.S. Thesis
C. K. Leong and H. Obonyo Jun. 1977 110 p refs
(BU-207) Avail: NTIS HC A06/MF A01

The fuel channel assembly in the pressure tube of a steam generating heavy water reactor consists of a T-junction, through which two-phase fluid under high pressures and temperatures flows. Fluid excitation at various points along the assembly is reported to manifest itself in vibrations of the hanger bar and the fuel-pin bundle it supports in the pressure tube. It is believed that the flow in the T-junction region could be a major source of the excitation. Initial investigations using a simple two-dimensional water channel model revealed that the flow in the junction region is not significantly affected by the position of the closing flange, for closing flange positions more than three diameters (maintube) from the junction. Based on this information, a subsequent full-scale air model was constructed to simulate the flow in the region of interest. The flow characteristics were observed by use of five different flow visualization techniques. It was found that the flow could be divided into six regions within which the character of the flow was largely uniform. Where vorticity clearly existed, its position and strength was not steady and this consequent switching contributed to oscillating pressures on the hanger bar and within the riser. Pressure measurements were also made to establish the mean force distributions on the hanger bar. A spectral study of the pressure was conducted at five preselected points along the hanger bar. The spectral density curves obtained showed that while there were persistent strong frequencies in the range f less than 50 Hz, the importance of higher frequencies (up to 125 Hz) varied from position to position along the hanger bar. Author (ESA)

N78-14361# Bristol Univ. (England). Dept. of Aeronautical Engineering.
INVESTIGATION INTO THE SEPARATION OF AN INCOMPRESSIBLE, TURBULENT BOUNDARY LAYER IN AN ASYMMETRIC DIFFUSER B.S. Thesis
P. D. Gilmartin and D. W. Hall Jun. 1977 47 p refs
(BU-211) Avail: NTIS HC A03/MF A01

An investigation into the nature of the development of an incompressible turbulent boundary layer, subjected to an adverse pressure gradient, sufficient to cause separation in an effectively two-dimensional asymmetric diffuser is described. Two configurations of diffuser were considered, each set of results being analyzed and examined in relation to the Coles wake hypothesis. A degree of distortion from the Coles hypothesis is shown to be present in both diffuser flows. This is believed to be the first time that such a distortion has been detected in a wholly subsonic flow. Extensive pressure distribution and profile parameter data are presented, the interpretation of which leads to the conclusion that profile distortion in an adverse pressure gradient is a function of the pressure gradient itself and, hence, of the diffuser angle. Recommendations for further investigations are included.
Author (ESA)

N78-14362# Washington Univ., Seattle. Dept. of Civil Engineering.
DYNAMIC SOIL PROPERTIES OF DEEP PACIFIC OCEAN CLAYS
Mehmet A. Sherif, Ramdane Khalid, and Isao Ishibashi Dec. 1976 200 p refs
(Grant NSF AEN-75-15818)
(PB-272432/6; Soil Engineering Research-16;
NSF/RA-761122) Avail: NTIS HC A09/MF A01 CSCL 08J

Dynamic shear moduli and strength degradation were studied for two seafloor sediments obtained from the deep Pacific Ocean; namely, a red clay (with high iron oxide content) and a yellowish brown pelagic clay. Based on experimental data obtained on the red clay a procedure was developed to determine the complex shear modulus as a function of strain level and consolidation pressure. It was found that due to rearrangement of structure, the effect of the number of cycles on complex shear modulus was negligible. The yellowish brown pelagic clay loses some strength when vibrated. The red clay did lose strength. GRA

N78-14185# European Space Agency, Paris (France).
HIGHLY CAMBERED BLADES IN CASCADES OSCILLATING IN A COMPRESSIBLE GAS
Robert Legendre *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1976-6 (ESA-TT-406) Oct. 1977 p 1-10 Transl into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-6, Nov.-Dec. 1976 p 301-305 Original report in FRENCH previously announced as A77-27026 (For availability see N78-14184 05-31)
Avail: NTIS HC A06/MF A01

N78-14186# European Space Agency, Paris (France).
SMALL UNSTEADY PERTURBATIONS OF A PERMANENT ONE-DIMENSIONAL FLOW
Pierre Carriere *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1976-6 (ESA-TT-406) Oct. 1977 p 11-41 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-6, Nov.-Dec. 1976 p 307-321 Original report in FRENCH previously announced as A77-27021 (For availability see N78-14184 05-31)
Avail: NTIS HC A06/MF A01

N78-14187# European Space Agency, Paris (France).
THEORETICAL AND EXPERIMENTAL STUDY OF A SUPERSONIC, ANNULAR, ROTATING CASCADE
Jacques Paulon and Jean-Pierre Veuillot *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1976-6 (ESA-TT-406) Oct. 1977 p 42-57 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-6, Nov.-Dec. 1976 p 323-331 Original report in FRENCH previously announced as A76-47376 (For availability see N78-14184 05-31)
Avail: NTIS HC A06/MF A01

N78-14990# European Space Agency, Paris (France).
ANALYTICAL MODELLING OF THE MOTION OF A DRAG-FREE SATELLITE
Alain Clochet and Francoise Paitel *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-3 (ESA-TT-415) Sep. 1977 p 12-31 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-3, May-Jun. 1977 p 139-146 Original report in FRENCH previously announced as A77-10973 (For availability see N78-14988 05-99)
Avail: NTIS HC A08/MF A01

N78-14991# European Space Agency, Paris (France).
STUDY OF INTERMITTENCY IN THE TRANSITION ZONE OF A BOUNDARY LAYER

Daniel Arnal and Jean-Claude Juillen *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977 - 3 (ESA-TT-415) Sep. 1977 p 32-70 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977 - 3, May-Jun. 1977 p 147-166 Original report in FRENCH previously announced as A77-38744 (For availability see N78-14988 05-99)
Avail: NTIS HC A08/MF A01

N78-14992# European Space Agency, Paris (France).
RESEARCH ON UNSTEADY TURBULENT BOUNDARY LAYERS
Jean Cousteix, Andre Desopper, and R. Houdeville *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-3 (ESA-TT415) Sep. 1977 p 71-96 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-3, May-Jun. 1977 p 167-177 Original report in FRENCH previously announced as A77-28936 (For availability see N78-14988 05-99)
Avail: NTIS HC A08/MF A01

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N78-14363 British Library Lending Div., Boston Spa (England).
THE HARDENING OF GELATINE, PARTICULARLY IN PHOTOGRAPHIC MATERIALS
E. Fuchs Aug. 1977 21 p refs Transl. into ENGLISH from Adhesion (West Germany), v. 5, no. 5, 1961 p 225-230
(BLL-RTS-10858) Avail: British Library Lending Div., Boston Spa Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

The melting and dissolution of gelatins begins between 30 and 34 C, depending on their molecular weights. Processes for raising this melting point as described in numerous German, U.S., and British patents are evaluated, and the photographic advantages and disadvantages of each are cited. A.R.H.

N78-14364* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FLOW SEPARATION DETECTOR Patent
George C. Mateer and Aviel Brosh, inventors (to NASA) (NAS-NRC) Issued 6 Dec. 1977 8 p Filed 6 Aug. 1976 Supersedes N76-28535 (14 - 19, p 2462)
(NASA-Case-ARC-11046-1; US-Patent-4,061,029; US-Patent-Appl-SN-712419; US-Patent-Class-73-180; US-Patent-Class-340-27SS) Avail: US Patent Office CSCL 14B

An arrangement for sensing the fluid separation along a surface which employs a thermally insulating element having a continuous surface blending into and forming a part of the fluid flow surface is described. A sudden decrease in the temperature of the downstream sensor conductor and concomitant increase in the temperature of the upstream sensor conductor is an indication of the separation. When the temperatures are returned to the state achieved during normal flow, the indicator thereby indicates the normal, attached fluid flow. The conductors may be, for example, wires or thin films, and should be within the viscous sub-layer of the expected fluid flow. A single heater and several pairs of sensors and corresponding sensor conductors may be used to detect not only the fluid flow and the separation, but the direction of the fluid flow over the fluid flow surface.
Official Gazette of the U.S. Patent Office

N78-14365 British Library Lending Div., Boston Spa (England).
CONSIDERATIONS ON THE COMPARISON OF RADIOMETERS, THEIR METHODS OF MEASUREMENTS AND FACTORS AFFECTING THEIR ACCURACY
D. Crommelynek [1977] 36 p refs Transl. into ENGLISH from Inst. R. Met. Belgique, Bibl. (Belgium), Ser. A, No. 89, 1975 p 1-29
(BLLD-M-24915-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

The calibration and the method of comparison of radiometers are considered as an introduction to the establishment of procedural rules for future comparisons of absolute radiometers. Real instrument characteristics are studied along with parameters of the environment which may influence radiometric comparisons. These include: the spatial distribution of irradiance from the radiative source, the wind speed and its direction, and the air temperature. J.M.S.

N78-14366 British Library Lending Div., Boston Spa (England).
HIGH-SENSITIVITY PHOTOGRAPHIC MATERIAL FOR ASTRONOMICAL PURPOSES: ITS DEVELOPMENT IN THE PHOTOGRAPHIC LABORATORY AND ITS APPLICATION TO PHOTOMETRY
D. A. Rozhkovskii Jun. 1977 60 p refs Transl. into ENGLISH from Tr. Astrofizicheskogo Inst. AN Kazakhsk. SSR (USSR), v. 25, 1975 p 38-74
(BLL-RTS-10673) Avail: British Library Lending Div., Boston Spa, Engl.: £15.00; 14 BLL overseas, 15 European or 60 UK BLL photocopy coupons

A short review is provided of the spectral properties of some emulsions which are of interest to astronomers, and formulae are listed for developing and sensitizing. Practical information is also presented, from the field of photometric application of photographic materials, which is of benefit to novice astronomers who want to become acquainted in detail with modern practical aspects of astrophotography. Author

N78-14367 British Library Lending Div., Boston Spa (England).
THERMOCOUPLE SHEATHS USED IN THE AUTOMATION OF THE THERMAL CONTROL OF METALLURGICAL PROCESSES
P. S. Kislyi, M. A. Kuzenkova, L. I. Struk, B. A. Morgunovskaya, V. K. Zvazhenko, A. G. Bolshenko, and V. I. Ostroverkhov 1972 16 p refs Transl. into ENGLISH from Porosh. Met. (USSR), no. 12 (120), 1972 p 49-56
(BLL-OA-Trans-1586-(6196.3)) Avail: British Library Lending Div., Boston Spa, Engl.

Thermocouple sheaths made of an alloy of zirconium diboride and tungsten were produced according to a conventional powder metallurgy method including, as main operations, charge preparation, forming, and sintering. The special features of the plasticizing of the charge with various plasticizers were studied and the method of die pressing for the shaping of sheaths was selected. The data obtained from the investigations into the sintering kinetics and the formation of the structure on the alloy in various gas media were used for determining the optimum sintering conditions for the sheath. Specific properties and the results of tests on the sheaths in cast iron and steel melts are pesented. Author

N78-14368 Michigan Univ., Ann Arbor.
SILICON DIAPHRAGM PRESSURE SENSORS WITH INTEGRATED ELECTRONICS Ph.D. Thesis
John Michael Borky 1977 203 p
Avail: Univ. Microfilms Order No. 77-17957

A class of pressure measuring devices incorporating a chemically etched thin silicon diaphragm containing a piezoresistive bridge responding to flexure of the membrane plus integrated signal conditioning electronics was investigated. The use of silicon as a mechanical sensing medium offers the combination of a sensitive basic mechanism and the ability to place active circuitry in the sensor itself using the highly developed technology of silicon integrated circuits. Signal processing functions such as amplification, temperature compensation, and analog-to-digital conversion can be performed in the sensor instead of in external electronics. Such active sensors have a wide range of potential applications ranging from industrial controls to biomedical instruments. A specific medical requirement for a catheter tip cardiovascular pressure instrument was chosen as a research vehicle. Dissert. Abstr.

N78-14369 Michigan Univ., Ann Arbor.
GENERALIZED BINARY COMPUTER GENERATED HOLOGRAMS: NOISE PROCESSES Ph.D. Thesis

Bruce David Hansche 1977 143 p
Avail: Univ. Microfilms Order No. 77-18020

Some noise processes particular to the GBH code were studied. Since the quantization step sizes were nonuniform, the effects of quantization noise were considered. It was found that, for transmittance functions which were bounded in amplitude, it was usually beneficial to normalize the function so that a few of the available quantization levels were not used. With some typical signal types, using a 5 x 5 code (which has 25 subcells per cell), an RMS quantization noise of 1.5 to 2 per cent was expected, if the function coded was sampled near the Nyquist rate. Oversampling tended to reduce the quantization error, since the quantization noise was spatially broadband, and some of it could be filtered out in the transform plane of the coded hologram. Dissert. Abstr.

N78-14370# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

REQUIREMENTS FOR HOLOGRAPHIC PHOTOGRAPHIC MATERIALS

I. S. Barbanel and E. I. Krupitskiy 28 Apr. 1977 20 p Transl. into ENGLISH from Zhurnal Nauchnoy i Prikladnoy Fotografii i Kinematografii (USSR), v. 17, no. 4, Jul. - Aug. 1972 p 276-281
(AD-A046220; FTD-ID(RS)I-0459-77) Avail: NTIS HC A02/MF A01 CSCL 14/5

Optimization of hologram preparation is considered to be of a dual nature requiring the synthesis of optimal photographic material and selecting an optimal recording regime. GRA

N78-14371# Northeastern Univ., Boston, Mass. Electronics Research Lab.

MSMP TIMER TESTING AND PROGRAMMING INSTRUMENT Scientific Report, 1 May 1976 - 30 Apr. 1977

Raimundas Sukys 1 May 1977 39 p refs
(Contract F19628-76-C-0152)
(AD-A046168; AFGL-TR-77-0206; SR-1) Avail: NTIS HC A03/MF A01 CSCL 14/2

This report describes a portable instrument designed to program and to test an airborne electronic multifunction timer-controller unit. This instrument programs the erasable and electrically programmable memories--EPROM's, used in the timer, with the necessary flight information. The performance of the timer can also be tested using this instrument. The report has three major divisions. The first section provides an overview of the instrument. The second part deals with circuit and operational details. The last section gives recommendations and conclusions for future instruments. Sketches of circuits and component layouts are also given. Author (GRA)

N78-14372# Accumetrics Corp., Cambridge, Mass.

APPLIED RESEARCH AND DEVELOPMENT ON TRIAXIAL PIEZOELECTRIC (PZL) ACCELEROMETER SYSTEMS OF IMPROVED DESIGN Final Report, Dec. 1975 - Jul. 1977

Donald H. Fryklund Aug. 1977 24 p
(Contracts F19628-76-C-0129; F19628-73-C-0112)
(AD-A046167; AC-227; AFGL-TR-77-0187) Avail: NTIS HC A02/MF A01 CSCL 14/2

This work comprised of the further development, fabrication and fielding of four AFGL piezoelectric atmospheric density measuring systems. Improvements were made in the accelerometer electronic system to further reduce interference due to body motion acceleration. Other improvements were made to simplify the system. A radar transponder was added to assist in tracking the payload which required re-integration of the total system. GRA

N78-14373# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

PREPARATION OF AERIAL PHOTOGRAPHS FOR ANALYSIS ON A TOPOGRAPHIC STEREOMETER

V. V. Pervozvanskiy 13 Apr. 1977 21 p Transl. into ENGLISH from Geod. i Kartografiya (Moscow, no. 9, Sep. 1960 p 32-36
(AD-A046219; FTD-ID(RS)I-0447-77; FTD-77-C-000347) Avail: NTIS HC A02/MF A01 CSCL 14/5

Studies were conducted to determine the advantages of a given type of photographic paper finish and the method of gluing it onto glass, as well as to explain the effect of these factors on the precision of stereotopographic work. The study program consisted of: (1) obtaining comparison data on the overall distortion of aerial photographs; (2) detecting local distortions; (3) obtaining comparison data on the resolution of each type of aerial photograph finish; and (4) determining the effect of the gluing method and finish of the photographic paper on the precision of stereotopographic work. The studies were conducted with measuring grids (Gautier) and aerial photographs on a scale of 1:15,000 printed on dispositive plates and on different photographic paper. Author

N78-14374# University of Southern Calif., Los Angeles. Image Processing Inst.

THE USC-IMAGE PROCESSING INSTITUTE DATA BASE, REVISION 1

Ray Schmidt Oct. 1977 44 p
(Contract F33615-76-C-1203; ARPA Order 3119)
(AD-A046215; USCIPI-780) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report represents effort expended in attempting to meet the needs of the ARPA-IPTO Image Understanding community in providing the availability of a digital image data base. The data base will never be complete as it is the intention of the USC-IMAGE Processing Institute to update and maintain the base as long as the sponsor and scientific community indicates a need for same. The picture files are individually or collectively accessible either over the ARPANET or via the U.S. mails. GRA

N78-14375# California Univ., Livermore. Lawrence Livermore Lab.

THE 2-mm MICROWAVE INTERFEROMETER

Archer H. Futch and W. K. Mortensen 1 Mar. 1977 15 p refs
(Contract W-7405-eng-48)
(UCRL-52245) Avail: NTIS HC A02/MF A01

A 2-mm microwave interferometer was developed, and phase shift measurements were made on the Baseball 2 experiment. The interferometer system employs a 140-GHz receiver for double down conversion of the plasma signal to a 60-MHz, IF frequency. The 140-GHz references signal is also down-converted and compared with the plasma signal to provide the desired phase change of the signal passing through the plasma. A feedback voltage from a 60-MHz discriminator to a voltage-controlled oscillator in the receiver provides frequency stability of the 60-MHz IF signals. ERA

N78-14376# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.

ON A CENTRIFUGAL SPECTROMETER WITH A PUNCTIFORM AEROSOL INLET [UEBER EIN ZENTRIFUGALSPEKTROMETER MIT PUNKTFOERMIGER AEROSOLEINSTROEMUNG]

T. Dahlem [1975] 41 p refs In GERMAN
(DLR-IB-553-75/13) Avail: NTIS HC A03/MF A01

A mechanical aerosol spectrometer separating selectively aerosol particles in a centrifugal field is described. The apparatus was charged with an aerosol of known particle size distribution and the particle distribution of the collector was investigated with respect to statistical parameters. The dependance of the precipitation location on the particle size was established. ESA

N78-14377# Lyon Univ. (France). Inst. de Physique Nucleaire.

PERFORMANCES OF SMALL AREA RECOIL WIRE CHAMBERS IN A-CO2 AND A-ISO C4H10 OPERATING GAS MIXTURES

J. P. Burq, M. Chemarin, M. Chevallier, B. Ille, M. Lambert, N. Madjar, J.-P. Martin, G. Maurelli, and P. Sahuc [1976] 18 p refs
(LYCEN-7653) Avail: NTIS HC A02/MF A01

The design of a recoil spectrometer to be used in the S 143 experiment at CERN necessitated the development of small area multiwire proportional chambers to measure the position of highly ionizing recoil particles. The particles to be detected were mainly tritons and charge two particles (helions) of a few MeV to about 70 MeV for tritons and 200 MeV for helions. One half of the

detector system consists of a block of four multiwave proportional chambers parallel to the beam axis, two arrays of silicon semiconductor detectors (300 micrometers (delta E) and 600 micrometers (E) thick) and two arrays of plastic scintillators (8 mm and 20 mm thick) enclosed in an aluminum octogonal chamber (spectrometer chamber). The recoil angle ranging from 60 to 230 deg was determined by the wire chambers (three for angle theta, one for angle phi), the recoil energy and identification parameters of the particles were delivered by the semiconductor and plastic scintillator detectors. Author (ESA)

N78-14378# Electricity Council Research Center, Capenhurst (England).
AN IMPROVED ANEMOMETER FOR ROOM AIR MEASUREMENTS
D. J. Dickson Aug. 1976 54 p refs
(ECRC/M977) Avail: NTIS HC A04/MF A01

Following a brief discussion of methods of measuring air velocity, a heated thermistor anemometer developed for room air measurements in the range 0.02 to 1 m/s is described. Unlike existing cooling-effect anemometers the calibration is independent of ambient air temperature in the range 10 to 25 C. Calibration procedures are described. Directional dependence is minimized by appropriate design of the sensing probe.
Author (ESA)

N78-14379# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.
THE USE OF PYRANOMETERS ONBOARD AIRCRAFT
Hans P. Fimpel 3 Jun. 1977 40 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-433)
(DLR-FB-77-24) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 18,50

The Moll-Gorczynski solarimeter and the Eppley pyranometer model PSP were investigated in order to find out whether they can be used for measurements onboard aircraft. The influence of temperature and pressure on the sensitivity, the dependence of the inclination, and the heating through high air-velocities were studied in laboratory and ground-based measurements. Measurements with an aircraft showed that the influence of quick variations of the air temperature can be easily corrected.
Author (ESA)

36 LASERS AND MASERS

Includes parametric amplifiers.

N78-14380* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LASER EXTENSOMETER Patent
Phillip J. Stocker (Rockwell International Corp., Canoga Park, Calif.) and Harris L. Marcus, inventors (to NASA) (Rockwell International Corp., Canoga Park, Calif.) Issued 6 Dec. 1977 5 p Filed 15 Oct. 1976 Supersedes N77-10516 (15 - 01, p 0071) Sponsored by NASA
(NASA-Case-MFS-19259-1; US-Patent-4,061,427; US-Patent-Appl-SN-732630; US-Patent-Class-356-159; US-Patent-Class-250-571; US-Patent-Class-356-160; US-Patent-Class-356-199) Avail: US Patent Office CSCL 20E

A drift compensated and intensity averaged extensometer for measuring the diameter or other properties of a substantially cylindrical sample based upon the shadow of the sample is described. A beam of laser light is shaped to provide a beam with a uniform intensity along an axis normal to the sample. After passing the sample, the portion of the beam not striking said sample is divided by a beam splitter into a reference signal and a measurement signal. Both of these beams are then chopped by a light chopper to fall upon two photodiode detectors. The resulting ac currents are rectified and then divided into one another, with the final output being proportional to the size of the sample shadow. Official Gazette of the U.S. Patent Office

N78-14381 Stanford Univ., Calif.
DESIGN OF A LASER INTERFEROMETER FOR MEASUREMENT OF EXTREMELY SMALL BIOLOGICAL MOTIONS: APPLICATION TO CRAYFISH GIANT AXON Ph.D. Thesis
Bruce Colman Hill 1977 118 p
Avail: Univ. Microfilms Order No. 77-18217

The interferometer was used to measure diameter changes in a giant axon from the crayfish Procambarus clarkii which occurred whenever the axon was stimulated to produce an action potential. The axon was removed from the animal and gold dust was placed on it to increase its reflectivity. It was found that there is a mechanical pulse which has the same all-or-nothing threshold as that of the action potential and has the same velocity. The average size of this motion is 10 Angstroms. Although most observations showed a contraction in the diameter followed by an expansion, some preparations produced different results, and the exact form of the motion is therefore not yet determined. Suggestions for improving the measurement technique were given. Dissert. Abstr.

N78-14382 Mississippi Univ., University.
INTERACTION OF NORMAL SHOCK WAVES WITH RAYLEIGH ATTENUATORS Ph.D. Thesis
Mulpuru Sambasiva Rao 1977 220 p
Avail: Univ. Microfilms Order No. 77-20191

The gasdynamic disturbances generated in an electric discharge gas laser were modeled by both an Eulerian and a Langragian formulation. The one-dimensional continuity, momentum, and energy equations are solved using finite-difference methods. The disturbances generated in the laser cavity for energy inputs of 200-500 Joules/liter are discussed. The interaction of an initial normal shock wave with a single traverse of the shock in the tube, was also modeled. The effectiveness of a Rayleigh attenuator mounted in a shock tube in reducing the amplitude of an initial shock wave over repeated traverses of the shock in the tube is demonstrated. Dissert. Abstr.

N78-14383 California Univ., Los Angeles.
ANALYSIS OF CONTINUOUS ELECTRON GUN PREIONIZED ELECTRIC LASER DISCHARGES Ph.D. Thesis
Leroy Vernon Sutter, Jr. 1977 149 p
Avail: Univ. Microfilms Order No. 77-19646

A two temperature laser kinetics model was developed for the CO2:N2:He laser system based on currently available V-V and V-T vibrational rate data. The two temperature laser kinetics model was coupled to the one-dimensional ideal gas-dynamic relations and to the gas discharge kinetics relations through the use of a computer algorithm. Experimental density and grain measurements are presented from data taken on a large bore continuous electric laser discharge using a 5:4:1 (He:N2:CO2) gas medium. The experimental setup and techniques involved in making these measurements are described and results of these measurements are compared to the predictions of the computer algorithm. Techniques in building large bore electric discharge lasers are also reviewed. Current problems based on the preceding analysis and future improvements in these devices are discussed. Dissert. Abstr.

N78-14384 Rice Univ., Houston, Tex.
PHASE DISPERSION IN MODE-LOCKED NEODYMIUM: GLASS LASERS, PART 1. INVESTIGATION OF THE PHOTOREFRACTIVE EFFECT IN IRON DOPED LITHIUM NIOBATE FOR HOLOGRAPHIC STORAGE APPLICATIONS, PART 2 Ph.D. Thesis
Rajiv Rajaram Shah 1977 163 p
Avail: Univ. Microfilms Order No. 77-19289

Time resolved linear interferometry shown to be a technique that measures the phase dispersion of the electric field vector in the ultrashort pulses from a modelocked laser system. The technique was used to analyze the dye mode-locked Nd(3+) glass laser. The results of the measurements indicate a rather rapid change in the phases between modes, and a plot of the phase change as a function of mode frequency was obtained. The photorefractive effect in iron doped lithium niobate was also investigated by means of phase holography for data storage and display applications. A nonlinear dynamic theory was developed for the formation of photorefractive volume phase holograms. This was accomplished by examing the feedback

mechanism between the photoexcited free electron density and the photogenerated space charge field. An expression for the diffraction efficiency of an attenuated photorefractive grating was obtained where the refractive index modulation of the grating evolves in time in accordance with the nonlinear dynamic theory. Dissert. Abstr.

N78-14385 Southern Methodist Univ., Dallas, Tex.
ELECTROMAGNETIC MODES OF HETEROJUNCTION INJECTION LASERS Ph.D. Thesis
Chung-Shu Wang 1977 168 p
Avail: Univ. Microfilms Order No. 77-18608

Theoretical modeling of heterojunction injection lasers was examined. Studies were made on two dimensional radiation patterns, mode reflectivities due to cleved facets, transverse mode selection, and the relationships between the threshold gain and aluminum concentration of various grown layers in the GaAs-AlGaAs device structure. Two dimensional mode confinement was discussed for several laser structures including string geometry devices. Radiation patterns and mode reflectivities were calculated using the two dimensional model. Transverse mode selection due to a thin film coating on the laser facet was examined. The threshold behavior for CW operation was investigated. The aluminum mole fraction in the active region determining the lasing wavelength, affects the active region gain at threshold. Lasers with a given active region width and index step have the smallest threshold gain when aluminum fraction of the active region is the largest; the peak fractional value of aluminum cannot exceed 0.37. Dissert. Abstr.

N78-14386*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DISTRIBUTION OF E/N AND N SUB e IN A CROSS-FLOW ELECTRIC DISCHARGE LASER
John W. Dunning, Jr., Richard B. Lancashire, and Eugene J. Manista 1976 17 p refs Presented at 29th Ann. Gaseous Electron. Conf., Cleveland, 19-22 Oct. 1976; sponsored by GE and Am. Phys. Soc.
(NASA-TM-73807; E-9390) Avail: NTIS HC A02/MF A01 CSCL 20E

The spatial distribution of the ratio of electric field to neutral gas density on a flowing gas, multiple pin-to-plane discharge was measured in a high-power, closed loop laser. The laser was operated at a pressure of 140 torr (1:7:20, CO2, N2, He) with typically a 100 meter/second velocity in the 5 x 8 x 135 centimeter discharge volume. E/N ratios ranged from 2.7 x 10 to the minus 16th power to 1.4 x 10 to the minus 16th power volts/cu cm along the discharge while the electron density ranged from 2.8 x 10 to the 10th power to 1.2 x 10 to the 10th power cm/3. Author

N78-14387*# California Univ., Berkeley. Lawrence Berkeley Lab.
OPTICAL TIMING RECEIVER FOR THE NASA LASER RANGING SYSTEM. PART 2: HIGH PRECISION TIME INTERVAL DIGITIZER
Branko Leskovar and Bojan Turko 25 Feb. 1977 74 p refs
(NASA Order S-55772-A; Contract W-7405-eng-48)
(NASA-CR-155513; LBL-6133-Pt-2) Avail: NTIS HC A04/MF A01 CSCL 20E

The development of a high precision time interval digitizer is described. The time digitizer is a 10 psec resolution stop watch covering a range of up to 340 msec. The measured time interval is determined as a separation between leading edges of a pair of pulses applied externally to the start input and the stop input of the digitizer. Employing an interpolation technique and a 50 MHz high precision master oscillator, the equivalent of a 100 GHz clock frequency standard is achieved. Absolute accuracy and stability of the digitizer are determined by the external 50 MHz master oscillator, which serves as a standard time marker. The start and stop pulses are fast 1 nsec rise time signals, according to the Nuclear Instrument means of tunnel diode discriminators. Firing level of the discriminator defines start and stop points between which the time interval is digitized. ERA

N78-14388# TRW Systems and Energy, Redondo Beach, Calif. Engineering Sciences Lab.
COMBUSTION PHENOMENA IN CHEMICAL LASERS Final Report, 1 May 1974 - 30 Sep. 1977
Francis E. Fendell 30 Sep. 1977 8 p
(Contract DAAG29-74-C-0023)
(AD-A045727; ARO-11674.7-E) Avail: NTIS HC A02/MF A01 CSCL 20/5

This final report briefly recapituates the problems studied, the results obtained, and the documents published under the subject project. Attention was focused on the modeling of 'pumping' phenomena (i.e., the formation of activated product gas HF*) in diffusion-type continuous (CW) chemical lasers of hydrogen-fluorine technology. The geometry examined was the 'basic building block' of conventional CW lasers, essentially the plane parallel mixing layer formed by coflowing streams of diatomic hydrogen and monatomic fluorine. (Aside from one task involving the two-step symmetrical chain reaction, in which the hot slow chemical reaction and the cold fast chemical reaction were considered, only the case of high dissociated fluorine was examined). The nature of reported unsteadiness in the lasing portion of the cavity was reviewed, in order to discern whether introduction of time-averaged modeling of turbulent diffusion flames is warranted for quantitatively accurate description of pumping. GRA

N78-14389# Aerospace Corp., El Segundo, Calif. Ivan A. Getting Labs.
SENSITIVE LASER SPECTROSCOPY MEASUREMENT TECHNIQUE
Donald J. Spencer 23 Sep. 1977 25 p refs
(Contract F04701-76-C-0077)
(AD-A045955; TR-0077(2607)-2; SAMSO-TR-77-199) Avail: NTIS HC A02/MF A01 CSCL 17/8

A simple differential measurement technique is described by means of which a sensitive determination can be made of a change in the laser-beam signal resulting from absorption, scattering, or gain while traversing a medium. The method depends upon the use of an internally modulatable laser for implementation. Sensitivities of delta I/I sub 0 = .0001 were routinely and unambiguously measured. Maximum sensitivity was measured at .00002. The method is applicable, in general, to steady phenomena or average value measurements. Two silicon photovoltaic detectors are employed in the differential measurement. The applicable wavelength domain of this technique is determined by the sensitivity range of the detectors, i.e., approximately 0.19 to 1.15 micrometers. Author (GRA)

N78-14390# Stanford Univ., Calif. Edward L. Ginzton Lab.
TUNABLE OPTICAL SOURCES Final Report, 1 Jul. 1974 - 30 Jun. 1977
R. L. Byer and S. E. Harris Jul. 1977 12 p refs
(Contract DAAG29-74-C-0033; DA Proj. 1T1-61102-BH-57)
(AD-A046004; GL-2728; ARO-12407.7-P) Avail: NTIS HC A02/MF A01 CSCL 20/6

Research briefly summarized here has dealt with a tunable coherent spectrometer using a Nd:YAG laser pumped LiNbO3 parametric oscillator, and the development and verification of the theory of resonantly two-photon pumped metal vapor up-converters, and the demonstration of practical devices arising from the theory. Author (GRA)

N78-14391# Los Alamos Scientific Lab., N. Mex. Theoretical Div.
NUMERICAL METHODS FOR TWO-DIMENSIONAL cw CHEMICAL LASER POWER CALCULATIONS
J. D. Ramshaw and T. D. Butler 1977 33 p refs Presented at Tri-Serv. Chem. Laser Symp., Huntsville, Ala., 1-3 Mar. 1977
(Contract W-7405-eng-36; AF Proj. 77-047)
(LA-UR-77-838; Conf-770341-1) Avail: NTIS HC A03/MF A01

The current status of two-dimensional chemical laser modeling at Los Alamos is reviewed, with emphasis on numerical methods for coupling the radiation field to the fluid dynamics so that laser power can be calculated. The RICE-RAD code was developed by incorporating radiation and lasing into the basic RICE code for transient compressible multicomponent reactive fluid flow. Example solutions are presented to illustrate the application of the code to several existing and proposed chemical laser systems. Finally, an alternate approximate method is described for

estimating laser power based on nonlasing (small-signal) vibrational distributions as input. ERA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N78-14392 British Library Lending Div., Boston Spa (England).
VARIABLE DISTRIBUTION FOR INTERNAL-COMBUSTION ENGINE WITH VALVE-TYPE DISTRIBUTION. EFFECTS ON PERFORMANCES AND EMISSIONS OF POLLUTING GASES AT THE EXHAUST
M. Claude Paulmier [1977] 31 p refs Transl. into ENGLISH from Ing. Auto. (Paris), Jun. - Jul. 1974 p 442-452
(BLLD-M-24909-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

A ballistic distributor which contains only the elements found with distribution by lateral camshaft and overhead valves was applied to the intake of an internal combustion engine to increase its durability and performance. Bench tests at idling, zero load, full load at 2000 rpm, and curve use of the engine in fourth gear were conducted to determine the effect of this ballistic variation on the concentration of hydrocarbons, carbon monoxide, and nitrogen oxides in the exhaust gases. The possibility of obtaining 80% reduction of unburned HC on idling, and 65% reduction of the nitrogen oxide on the engine utilization curve at 1% carbon monoxide was demonstrated. Author

N78-14393 British Library Lending Div., Boston Spa (England).
CHEMICO-MECHANICAL CLEANING OF INTERNAL SURFACES OF PIPES
D. M. Mubinov and E. M. Gutman Jul. 1977 4 p Transl. into ENGLISH from Lakokrasoch. Mater. Ikh Primen. (USSR), v. 1, 1976 p 36-37
(BLL-RTS-10759) Avail: British Library Lending Div., Boston Spa, Engl.: £3.00; 3 BLL overseas, 3 European or 12 UK BLL photocopy coupons

The advantages of cleaning the internal surfaces of pipes by using pressed steel wire elements to ensure gross removal of oxide film with micro-cutting of the metal surface and the simultaneous chemical treatment of the scraped surface were investigated. This method of oxide removal speeds up the process fourfold compared with chemical treatment, and by 30 to 50% compared with mechanical treatment. The chemically active substances are aqueous solutions of mineral acids, surface active agents and defoamers. The internal surfaces of pipes are best treated by a solution of phosphoric acid which has no deleterious effects on the properties of metal, especially, in the vicinity of welding seams. For the combined de-greasing and oxide removal, the biologically degradable surface active agents sulfanol and sintanol are recommended. Author

N78-14394 British Library Lending Div., Boston Spa (England).
SCREW-CUTTING BY MEANS OF SINGLE-POINT HARD METAL TOOLS
W. Du Mong Jul. 1977 25 p refs Transl. into ENGLISH from Metaalbewerking (West Germany), v. 42, no. 17, 1976 p 361-365
(BLL-RTS-10483) Avail: British Library Lending Div., Boston Spa, Engl.: £15.00; 14 BLL overseas, 15 European or 60 UK BLL photocopy coupons

Some working hypotheses for the determination of the cutting conditions in case of screw-cutting by means of hard metal tools are discussed. On basis of comparative tests it is demonstrated that screw-cutting employing constant infeed is advantageous when compared with screw-cutting employing a constant cross section of the chip. Author

N78-14395 Virginia Polytechnic Inst. and State Univ., Blacksburg.
GATE DESIGN FOR INJECTION MOLDS Ph.D. Thesis
Jorge Enrrique Echenagucia 1977 190 p
Avail: Univ. Microfilms Order No. 77-20234

A design procedure for gates and runner systems for injection molds of pseudoplastic materials was developed. The steps followed included: (1) selection of a suitable polymer for molding purposes; (2) determination of a viscosity-shear rate-temperature relationship for polyethylene; (3) development of a mathematical model of the complete injection molding cycle; (4) design and construction of an injection mold and monitoring system to validate the proposed model; and (5) development of a gate design procedure based on the predictions of the model. Dissert. Abstr.

N78-14396 Wisconsin Univ., Madison.
UNDERWATER WELDING OF MILD STEEL: A METALLURGICAL INVESTIGATION OF THE CRITICAL FACTORS Ph.D. Thesis
Vedapurisan Nagarajan 1977 227 p
Avail: Univ. Microfilms Order No. 77-14352

Underwater welding was performed in a laboratory tank with continuous circulation of water, to simulate the cooling rate and solidification phenomena encountered in the actual practice of underwater welding. Visibility was improved by the development and use of a periscopic arrangement. The ease of welding was further enhanced by the use of a guide plate arrangement. A touch welding technique was employed, and all the welding was performed with direct current, reverse polarity arrangement. The specific effects of water as a medium of welding was investigated by means of a shape relationship study. Measurements of the bead shape, geometry, heat affected zone width, and penetration depth led to the calculations of bead shape factor (bead width/penetration depth). The welding conditions were varied by varying heat input and base plate thickness, and comparisons were made between shape relationships under water and open air. Dissert. Abstr.

N78-14397 Carnegie-Mellon Univ., Pittsburgh, Pa.
A HYDRODYNAMIC AND HEAT TRANSFER ANALYSIS OF ROUGH SURFACES APPLIED TO LUBRICATION Ph.D. Thesis
Gerard Gregory Ellia 1977 117 p
Avail: Univ. Microfilms Order No. 77-19360

A model of surface roughness is developed. The concept of a rough cell permits a general analysis of any type of bearing with roughness patterns characterized by arbitrary height and wave length. The model illustrates the effects of moving surface roughness. Results of other investigators, previously thought to describe double rough surface bearings, are shown to be special cases of stationary surface roughness. Heat transfer effects associated with the fluid dynamics of rough surfaces are also presented. Dissert. Abstr.

N78-14398 Central Electricity Generating Board, London (England).
DETERMINATION OF THE PARAMETERS OF ROTATING MACHINES. IDENTIFICATION OF A QUANTITY COMPRISING A SUM OF EXPONENTIAL TERMS
D. Petrovic 25 May 1977 17 p refs Transl. into ENGLISH from Bull. Dir. Etud. Rech., Ser. B. (France), no. 1, 1975 p 19-28
(BLL-CE-Trans-7031-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.

The parameters of a.c. machines are estimated based on the experimental determination and identification of the decay of a direct current in the field and armature circuits with the rotor locked and on the determination of the coefficients of the exponential terms. The case where the measured values differ from the exponential function according to a normal law is examined along with measurement conditions of the initial function which will lead to a satisfactory identification. Author

N78-14399 British Library Lending Div., Boston Spa (England).
ATTEMPTS TO CLEAN GUIDE BLADES AND MOVING BLADES OF STEAM TURBINES
T. Henning 21 Jul. 1977 10 p Transl. into ENGLISH from German Conf. Paper-10 Presented at the VGB seminar Maintenance, Essen, 24 - 25 Feb. 1976
(BLL-CE-Trans-7107-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.

Sand, water, and cement were used to determine the most suitable agent for removing different layers of Fe_3O_4 and SiO_2 from the various blading sections of a steam turbine without producing surface roughness or even cracks. Pure Fe_3O_4 layers were removed satisfactorily with cement; however, blasting with

pure sand alone gave a better surface finish and required less blasting material. Treatment of the SiO2 layers with water and sand required more time and material than the dry sandblasting treatment. Blasting with a sand-water mixture consumed five times the quantity of sand needed for dry treatment, took 2.4 times as long, and involved the risk of component corrosion. Blasting with water alone was unsuccessful. Dissert. Abstr.

N78-14400 British Library Lending Div., Boston Spa (England).
PARAMETERS FOR THE PERFORMANCE ANALYSIS AND SCALE-UP OF TURBOMACHINES
D. Surek [1977] 22 p refs Transl. into ENGLISH from Maschinenbautechnik (East Ger.), v. 19, no. 11, 1970 p 547-580
(BLL-ME/77/3) Avail: British Library Lending Div., Boston Spa, Engl.

By using dimensionless flow coefficients, certain overall flow factors were defined which are particularly suitable for the analysis and comparison of pumps within a series, or for individual flow machines. In addition, these factors helped to determine the optimum operating region for flow machines as a function of specific speed. This mathematical process may be confirmed both qualitatively and quantitatively by the analysis of single and multistage radial flow machines. Author

N78-14401 British Library Lending Div., Boston Spa (England).
FORGINGS IN VEHICLE CONSTRUCTION
W. Adlof 25 May 1977 16 p Transl. into ENGLISH from Ind.-Anz. (Essen), v. 98, no. 93, 1976 p 1657-1661
(BLL-NEL-TT-2733-(6075.461)) Avail: British Library Lending Div., Boston Spa, Engl.

Examples of forgings used in the construction of automobiles are discussed. Emphasis is placed on savings made in weight, machining, and fuel consumption. J.M.S.

N78-14402 British Library Lending Div., Boston Spa (England).
EXTERNAL AND INTERNAL GEAR PUMP DISCHARGE AND ITS NON-UNIFORMITY
W. Gutbrod 25 May 1977 27 p refs Transl. into ENGLISH from Oelhydraulic und Pneumatik (West Ger.), v. 19, no. 2, 1975 p 97-104 In ENGLISH and GERMAN
(BLL-NEL-TT-2739-(6075.461)) Avail: British Library Lending Div., Boston Spa, Engl.

The theoretical relationships of the maximum and minimum discharge of external and internal gear pumps are examined and the discharge pulsations of the two types of pumps are studied with particular emphasis on the effect of the profile shift and addendum factors, as well as variations in the number of teeth. By varying these parameters, possibilities arise for reducing the degree of nonuniformity in liquid flow. The effects of these pulsations on the pressure pulsations, are discussed in relation to gear pump noise reduction. Author

N78-14403 British Library Lending Div., Boston Spa (England).
NOISE REDUCTION IN HYDRAULIC DRIVE SYSTEMS FOR MACHINE TOOLS
K. Schoeller 25 May 1977 14 p refs Transl. into ENGLISH from Oelhydraulic und Pneumatic (West Ger.), vol. 20, no. 6, 1976 p 387-390 In GERMAN and ENGLISH
(BLL-NEL-TT-2715-(6075.461)) Avail: British Library Lending Div., Boston Spa, Engl.

Noise reduction in installations as comprehensive as transfer lines was discussed as being achieved by an entire package of measures headed by the choice of a low noise pump. Various reduction measures such as (1) carcass noise insulation, (2) pulsation dampers, (3) hydraulic units, and (4) improvement of pumps were suggested and discussed in detail. B.B.

N78-14404 British Library Lending Div., Boston Spa (England).
NOISE REDUCTION BY SUITABLE CHOICE OF DISPLACEMENT-TYPE PUMPS AND THEIR PARAMETERS
P. Wuesthof 25 May 1977 17 p refs Transl. into ENGLISH from Oelhydraulic und Pneumatik (West Ger.), v. 20, no. 7, 1976 p 457-461 In GERMAN and ENGLISH
(BLL-NEL-TT-2719-(6075.461)) Avail: British Library Lending Div., Boston Spa, Engl.

An attempt was made to examine the noise output of different patterns of pump comparatively as a function of pressure, reaction speed and displaced volume. It was found that as a rule a reduction of reaction speed and a division of the total oil flow into smaller units are particularly effective. Author

N78-14405 British Library Lending Div., Boston Spa (England).
POSSIBILITIES OF REDUCING NOISE FROM HYDRAULIC VALVES
G. Schmid 25 May 1977 13 p Transl. into ENGLISH from Oelhydraulic und Pneumatic (West Ger.), v. 21 no. 2, 1977 p 89-91 In ENGLISH and GERMAN
(BLL-NEL-TT-2737-(6075.461)) Avail: British Library Lending Div., Boston Spa, Engl.

Noise emission from hydraulic valves cased by intermittent flow processes which arise at restriction point and/or by pressure pulsations caused by the pump was examined. Test carried out with flow and pressure valves show that the intensity of flow noise depends on the volume of flow and on the pressure differential at the valve. The influence exerted by the various types of resistances and by the materials from which the housings were made was determined and low-noise types of resistances were developed. A simple procedure is described for calculating the acoustic response level of a hydraulic valve through liquid sound. Author

N78-14406 British Library Lending Div., Boston Spa (England).
EFFECT OF THE DESIGN OF EXTERNAL GEAR PUMPS ON THE NOISE EMITTED BY THEM IN SERVICE
S. Stryczek 25 May 1977 11 p refs Transl. into ENGLISH from Oelhydraulic und Pneumatik (West Ger.), v. 20, no. 12, 1976 p 813-815 in ENGLISH and GERMAN
(BLL-NEL-TT-2732-(6075.461)) Avail: British Library Lending Div., Boston Spa, Engl.

Various shapes and sizes of key elements in a gear pump were used in a test pump constructed to identify and locate the most important pump noise sources, thus enabling effective noise reduction during pump design. Factors studied include the effects of different numbers of teeth of a gear pair, the end and radial clearances, and the bearing of the gears on the pump casing. A.R.H.

N78-14407 Ecole Polytechnique Federale de Lausanne (Switzerland). Inst. de Thermique Appliquee.
PUMPING PHENOMENON OF COMPRESSORS AND TURBOPUMPS AS NONLINEAR OSCILLATION [DER PUMPVORGANG VON VERDICHTERN UND KREISELPUMPEN ALS NICHTLINEARE SCHWINGUNG]
A. J. T. Horvath 1976 136 p refs In GERMAN; ENGLISH summary
(EPFL-ITA-3) Avail: Juris-Verlag, Zurich, 16 SFR

Unsteady flow phenomena, so-called surging, are known to occur in duct systems comprising turbopumps, turbocompressors or fans if the volume flow rate being delivered falls below a certain limit. Surging is associated with self-excited fluctuations of pressure and flow rate of definite periodicities. A mathematical description of a surging process is presented in the form of a non-linear differential equation which is an extended form of the equation of Van der Pol. Application of the theory to several systems investigated experimentally by other authors (involving axial and centrifugal compressors and centrifugal pumps) shows very good agreement of surging frequencies, amplitudes and waveforms. The analogies between the self-exciting behavior of tunnel (Esaki) diodes, gas compressors, and hydraulic pumps are also considered. Author (ESA)

N78-14408# Royal Aircraft Establishment, Farnborough (England).
FATIGUE STRENGTH OF JOINTS WITH SPECIAL FASTENERS, PART 2
J. J. Gerharz and D. Schuetz Mar. 1977 25 p refs Transl. into ENGLISH of "Die Schwingfestigkeit von Feugungen mit Sonderbefestigungselementen', Rept. LBF-TM-74/75 Lab. fuer Betriebsfestigkeit, Darmstadt, West Ger.
(RAE-Lib-Trans-1920; BR58376; LBF-TM-74/75) Avail: NTIS HC A02/MF A01

Results of fatigue tests on three types of joints made with various fatigue resistant fasteners are discussed. The tests were carried out using both block program and flight simulation loading

sequences. The results were analyzed and the factors which influenced fatigue lives of the joints are elaborated. Author

N78-14409# Royal Aircraft Establishment, Farnborough (England).
THE EFFECT OF DESIGN AND PRODUCTION PARAMETERS ON THE FATIGUE STRENGTH OF JOINTS
D. Shuetz and J. J. Gerharz May 1977 16 p refs Transl. into ENGLISH of "Der Einfluss von Fertigungsparametern auf die Schwinfestigkeit von Fuegungen", Rept. LBF-TM-72/73 Lab. fuer Betriebsfestigkeit, Darmstadt, West Ger.
(RAE-Lib-Trans-1921; BR58839; LBF-TM-72/73) Avail: NTIS HC A02/MF A01

Fatigue strengths of shear joints are studied with particular reference to local stresses and associated mechanisms. The joint parameters discussed include those associated with the fastener system, both geometric and assembly effects, hole preparation and joint surface effects. The influence of individual parameters are analyzed qualitatively, but little attempt has been made to access many of the interactive effects between the parameters. Author

N78-14410# Royal Aircraft Establishment, Farnborough (England).
DESIGN OF HELICAL TEETH FOR BENDING
T. V. Dolgova May 1977 12 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Mashinostr. (USSR), no.11, 1974 p 27-40
(RAE-LIB-Trans-1925; BR58545) Avail: NTIS HC A02/MF A01

A solution is given to the problem of selecting the shape coefficient of a helical gear tooth and the accuracy of existing calculations for helical gears. Author

N78-14411# Air Force Systems Command, Wright-Patterson AFB, Ohio.
HEAT-RESISTANT EQUIPMENT FOR BENDING SHAPED MATERIAL WITH ELECTRICAL HEATING
I. V. Korchagina and V. G. Borisov 21 Jan. 1977 13 p Transl. into ENGLISH from Tr. Kaz. Aviats. Inst. (Kazan), no. 152, 1973 p 15-18
(AD-A045909; FTD-ID(RS)I-1857-76) Avail: NTIS HC A02/MF A01 CSCL 13/8

The improvement of airplanes has lead to expanded use in designs of shaped material of high-strength alloys which, as a rule, are hard to work. This has made it necessary to develop and implement new forming processes. One of the most promising forming processes for shaped parts, which drastically reduces labor sent in bending and finishing operations and which increases the precision of the part, is bending with tension using electrical contact heating of the billet. Optimal temperature forming intervals are: for aluminum and magnesium alloys 200-400 C, titanium alloys OT4 500-700 C, VT14 600-750 C, VT20 700-900 C, high-strength stainless steels 800-900 C.
Author (GRA)

N78-14412# Air Force Packaging Evaluation Agency, Wright-Patterson AFB, Ohio.
TEST AND EVALUATION OF BL-755 TALL UNIT CONTAINER
Edward J. Kowalski Sep. 1977 11 p
(AD-A046122; PTPD-77-36) Avail: NTIS HC A02/MF A01 CSCL 13/4

One each BL-755 container with four each inert tail units was received from HQ ADTC/SDMT, Eglin AFB, Fla. at the Air Force Packaging Evaluation Agency, Wright-Patterson AFB OH. Rough handling tests were conducted on the container in accordance with Federal Test Method Standard 101B. Visual inspection indicated no physical damage to the container upon completion of the tests. Author (GRA)

N78-14413# Environmental Protection Agency, Ann Arbor, Mich. Standards Development and Support Branch.
PREDICTION OF DYNAMOMETER POWER ABSORPTION TO SIMULATE LIGHT DUTY VEHICLE ROAD LOAD
Glenn D. Thompson Apr. 1977 49 p refs
(PB-272169/4; LDTP-77-1) Avail: NTIS HC A03/MF A01 CSCL 14B

Dynamometer power absorption information was used to develop equations for predicting the small twin roll dynamometer power absorption necessary to simulate the road load of vehicles. The equations were developed by proposing model equations to predict the dynamometer power absorption, first based on vehicle weight, and then based on the vehicle reference frontal area. It is concluded that the errors associated with the prediction system are twenty percent less than the errors associated with a prediction system based on the vehicle weight only. Author

N78-14414# National Highway Traffic Safety Administration, Riverdale, Md.
USING AN OUTFLOW METER TO PREDICT BRAKING TRACTION SPEED GRADIENTS AS A FUNCTION OF SURFACE TEXTURE
John Hinch Aug. 1977 40 p
(PB-271971/4; DOT-HS-802584) Avail: NTIS HC A03/MF A01 CSCL 13B

The outflow meter was tested for use in prediction at speed gradient properties of a surface for both peak and slide traction coefficients. Several analytical methods were used to correlate gradient to outflow time resulting in fair correlation coefficients. The results of the test show the outflow meter can only determine trends in speed gradients. Author

N78-14415# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
USE OF EXTREMELY HARD SOVIET ABRASIVES FOR PRECISION MACHINING
F. Gruenwald and G. Boeswetter 18 Feb. 1977 22 p refs Transl. into ENGLISH from Fertigungstech. Betr. (East Ger.), v. 24, no. 12, 1974 p 713-718
(AD-A045924; FTD-ID(RS)I-0062-77; FTD-77-C-000-183) Avail: NTIS HC A02/MF A01 CSCL 11/11

The evaluation of the Soviet literature shows that synthetic polycrystalline diamonds and tools mounted with 'Elbor-R' can be used in precision machining. The efficiency of these tools equals or exceeds that of natural diamonds. This review and the information contained therein should serve as a stimulus and an orientation for a use of the tools discussed. The documentation of the VEB First Machine Shop of Carl Marx City is recommended to those interested in turning with 'Elbor-R' turning tools, since important details and examples of machining are spelled out there. Finally, it can be stated that particularly 'Elbor-R' tools significantly widen the machining of hardened iron materials that previously were machinable only by grinding or electro-erosivally or electro-chemically, they make possible the heat treatment of steels before the chip-removing machining operation, and they can partially replace grinding by turning or drilling. Author (GRA)

N78-14416# Oak Ridge Y-12 Plant, Tenn. Fabrication Systems Dept.
MATERIAL REMOVAL IN PRECISION MACHINING
T. A. Morris and K. J. Trigger (Ill. Univ., Urbana) 16 May 1977 26 p refs Presented at Soc. Mfg. Engr. Precision Machining Workshop, Phoenix, Ariz, 24-26 May 1977
(Contract W-7405-eng-26)
(Y/DA-7175; Conf-770532-1) Avail: NTIS HC A03/MF A01

Factors such as part figure, dimensional tolerance, surface finish, and surface integrity are considered. Methods and experineces in obtaining these important factors within the Oak Ridge Y-12 Plant are discussed along with enough metal-cutting theory to illustrate the methods and formulation of these methods. ERA

N78-14417# Sandia Labs., Albuquerque, N. Mex.
TWO-DIMENSIONAL STRESS WAVE CALCULATIONS OF KINETIC ENERGY PROJECTILE IMPACT ON MULTI-LAYERED TARGETS
L. D. Bertholf and M. E. Kipp 1977 29 p refs Presented at 3d Intern. Symp. on Ballistics, Karlsruhe, West Ger., 23 Mar. 1977 Sponsored in part by Army Ballistic Res. Labs.
(Contract EY-76-C-04-0789)
(SAND-76-9247; Conf-770328-1) Avail: NTIS HC A03/MF A01

The oblique impact of a cylindrical projectile onto a space armor target is approximated using two-dimensional elastic-plastic

Eulerian and Lagrangian stress wave propagation computer programs. Penetration of the first two armor layers by a tungsten alloy projectile is calculated for a number of different conditions to indicate the effects of varying the armor and projectile yield stress, interface friction, and the iron alpha reversible epsilon phase change. Results are summarized by examining changes in projectile residual with a constant target areal density which is also included for a depleted uranium projectile to illustrate the effects of realistic changes in target impedance and strength.
ERA

N78-14418# California Univ., Livermore. Lawrence Livermore Lab.
APPLICATION OF ADINA TO NONLINEAR CONTACT PROBLEMS
B. J. Benda and R. C. Greenlaw 14 Jun. 1977 25 p refs Presented at ADINA Conf., Cambridge, Mass., 4 Aug. 1977
(Contract W-7405-eng-48)
(UCRL-79593; Conf-770813-1) Avail: NTIS HC A02/MF A01

Analytical efforts to determine contact forces generated by various seal configurations indicate the need for a finite element code that can efficiently solve static, nonlinear contact problems. Initial efforts to determine contact forces around a compressed, hollow-metal O-ring with ADINA were not successful. As originally coded, the nonlinear truss, used as a gap element, could not adequately model the expanding zone of contact between the O-ring and its slotted, capture flanges. After modifying the truss subroutine, enabling the element to properly determine gap closure, problems were run to determine the effect of various parameters on program solution. Among the parameters studied were the effects of equilibrium iteration, the magnitude of the truss-gap element stiffness, the integration order of the O-ring elements, and the size of the load step. Results of these analyses are discussed as well as the adequacy of the nonlinear truss as a gap element. The basis for a proposed, multinode gap and boundary element is presented. ERA

N78-14419# Westinghouse Electric Corp., Lester, Pa.
HIGH TEMPERATURE TURBINE TECHNOLOGY PROGRAM. PHASE 1: PROGRAM AND SYSTEM DEFINITION. TOPICAL REPORT: OVERALL PLANT DESIGN DESCRIPTION, LOW BTU COMBINED CYCLE ELECTRIC POWER PLANT
Jan. 1977 211 p
(Contract EX-76-C-01-2290)
(FE-2290-18) Avail: NTIS HC A10/MF A01

A systems design is described for a combined cycle based on a high temperature turbine technology 2600 F combustion turbine operating with a low Btu coal-derived gaseous fuel. The information presented includes material on cycle and plant configuration, site plan, and the control system. In addition, the design requirements of the power plant are defined to include an integrated program on maintenance and reliability. Techniques available to analyze power plant equipment and systems from a reliability and availability viewpoint are described. Finally, a dissertation on various plant operating modes is presented along with a segment on a cycle utilizing an alternate high temperature hot fuel gas cleanup system. ERA

N78-14420# Westinghouse Electric Corp., Lester, Pa.
HIGH TEMPERATURE TURBINE TECHNOLOGY PROGRAM. PHASE 1: PROGRAM AND SYSTEM DEFINITION. TOPICAL REPORT: OVERALL PLANT DESIGN DESCRIPTION LIQUID FUEL COMBINED CYCLE ELECTRIC POWER PLANT
Jan. 1977 123 p
(Contract EX-76-C-01-2290)
(FE-2290-19) Avail: NTIS HC A06/MF A01

A combined cycle plant which utilizes an advanced 2600 F inlet temperature combustion gas turbine engine and burns a coal-derived liquid fuel is described. The plant is intended to serve the base and intermediate loads of a utility system. This operation requires that the equipment be capable of cyclic duty and of starting and accelerating to a full load condition in approximately one hour. The plant is comprised of two air-cooled dual liquid fuel combustion gas turbine engines, each rated at a gross output of 122,663 KW. The 1200 F exhaust heat of each combustion turbine is recovered in an unfired Heat Recovery Steam Generator (HRSG) generating steam at 1800 psig/1000 F/1000 F. The combined heat balance of the plant after allowing 7150 KW for total plant auxiliary power, shows a HHV heat rate of 6966 Btu/KwHr at a net plant output of 383,206 KW. This heat rate translates to an overall efficiency of 49 percent.
ERA

N78-14421# Westinghouse Electric Corp., Lester, Pa.
HIGH TEMPERATURE TURBINE TECHNOLOGY PROGRAM. PHASE 1: PROGRAM AND SYSTEM DEFINITION. TOPICAL REPORT: PHASE 3, PRELIMINARY TURBINE SUBSYSTEM TECHNOLOGY READINESS VERIFICATION PROGRAM PLAN Topical Report
Jan. 1977 79 p
(Contract EX-76-C-01-2290)
(FE-2290-21) Avail: NTIS HC A05/MF A01

A proposed plan is presented for the development of the high temperature gas turbine subsystem and the development and integration of the remaining elements required for the timely development of a coal gasification combined-cycle power plant.
ERA

N78-14422# Westinghouse Electric Corp., Lester, Pa. Generation Systems Div.
HIGH TEMPERATURE TURBINE TECHNOLOGY PROGRAM. PHASE 1: PROGRAM AND SYSTEM DEFINITION. TOPICAL REPORT: REFERENCE TURBINE SUBSYSTEM DESIGNS, PRIMARY AND BACKUP CONCEPTS
Feb. 1977 281 p refs
(Contract EX-76-C-01-2290)
(FE-2290-25) Avail: NTIS HC A13/MF A01

A four-stage turbine, air-cooled by advanced transpiration and impingement/convection cooling techniques and a turbine concept which uses water-cooled vanes and steam-cooled blades in the first two turbine stages were studied. Engine and combined cycle performance studies led to a single-shaft engine with an air flow of 754 lb/sec and pressure ratio of 15:1. The preliminary turbine design effort is described. Analysis of the flow path for both air and water-steam cooling, approaches, determination of cooling requirements, and preliminary thermal and mechanical design of critical vane and blade components are included. The results of the analysis and design effort are presented. ERA

N78-14423# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
PRINCIPLES OF OPERATION AND DATA REDUCTION TECHNIQUES FOR THE LOFT DRAG DISC TURBINE TRANSDUCER (DTT)
S. Silverman Feb. 1977 174 p refs
(Contract EY-76-C-07-1570)
(TID-27656) Avail: NTIS HC A08/MF A01

A transducer for measuring primary system mass flow rates in LOFT experiments was designed which combines a drag dose and turbine in a single unit. The available experimental data for the LOFT turbine in single-phase, all water flow, were summarized. The turbine dynamic response in all steam and in all water was also considered. Two of the available turbine meter models for two-phase flow were reviewed. The results predicted by the models are compared with the available two-phase flow data. A flow map for the full tests was presented. The drag disc in single-and two-phase flow was reviewed. Theoretical predictions were compared with the available experimental data. In addition, the dynamic response and the weight calibration of the drag disc were considered. Methods were presented for applying the drag disc and turbine data to two-phase flow. ERA

N78-14424# Transportation Systems Center, Cambridge, Mass.
A SEMI-AUTOMATED PULSE-ECHO ULTRASONIC SYSTEM FOR INSPECTING TIRES Interim Report, Jan. 1975 - Aug. 1976
Robert P. Ryan Jul. 1977 58 p
(PB-272323/7; DOT-TSC-NHTSA-76-3; DOT-HS-802-104)
Avail: NTIS HC A04/MF A01 CSCL 13F

A nondestructive tire-testing system was developed using the pulse-echo ultrasonic technique, which offers substantial advantages over all other physical nondestructive-testing methods and shows promise of reducing the cost of production-tire

inspection. The system was specifically designed to meet the requirements for detecting flaws in new tires. If satisfactory correlation can be demonstrated, the system may be used to screen larger samples of tires before testing for compliance with Motor Vehicle Standard 109. The ultrasonic techniques, the operation of the system and examples of data displays produced by the system test result from a small sample of tires are presented. GRA

N78-14425# Texas A&M Research Foundation, College Station.
TIRE-PAVEMENT INTERFACE VARIABILITY, VOLUME 2 Final Report, Jul. 1975 - Feb. 1977
Gordon G. Hayes Aug. 1977 174 p refs
(Contract DOT-HS-5-01190)
(PB-272289/0; RF3256-Vol-2; DOT-HS-802-554) Avail: NTIS HC A08/MF A01 CSCL 13F

To account for or eliminate the effects of surface properties on vehicle handling performance measured in established open-loop tests, various measures of surface properties were compared to vehicle test results on disparate surfaces. None of the nonvehicle textural and friction measures correlated well with vehicle performance. However, the vehicle performance was relatively insensitive to pavement properties on dry, stable surfaces. The peak 'coefficient of friction' with partial braking using a tire tester was also insensitive to pavement differences. Surfaces that produced some differences in vehicle performance also produced relatively large differences in the locked-wheel 'coefficient of friction' obtained with a standard skid measurement system. Author

N78-14426# Kusko (Alexander), Inc., Needham Heights, Mass.
FLYWHEEL PROPULSION SIMULATION Final Report
Alexander Kusko and Charles M. King May 1977 196 p refs
(Contract DOT-TSC-1180)
(PB-272259/3; UMTA-MA-06-0044-77-1;
DOT-TSC-UMTA-77-15) Avail: NTIS HC A09/MF A01 CSCL 13F

The analytical models and digital computer simulations that can be used for the evaluation of flywheel-electric propulsion systems employed with urban transit vehicles operating over specified routes and with predetermined velocity profiles were developed and described. The computer simulation was divided into two sections. The first section simulates the dynamic behavior of the vehicle enroute, computes the energy and power requirements, and the power losses of each of the propulsion system components. The second section uses thermal models to compute the temperature rises of each of the propulsion system components. The simulations can be used to determine the suitability of a given flywheel electric propulsion system for an intended mission. Author

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N78-14427 British Library Lending Div., Boston Spa (England).
DEFECT ANALYSIS AND THE POSSIBILITIES PROVIDED BY A SCANNING ELECTRON MICROSCOPE
J. Y. Boulaire and J. P. Boulet Apr. 1977 18 p Transl. into ENGLISH from Onde Elec. (France), v. 53, no. 4, 1973 p 127-132
(BLL-PO-3390-(9022.81)) Avail: British Library Lending Div., Boston Spa, Engl.

The possibilities provided by the scanning electron microscope are presented with descriptions of different types of semiconductor component analysis. A restatement of the principle of the device and the different modes of operation makes it possible to define the interpretation of the photographs illustrating the different analysis. Author

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N78-14428 British Library Lending Div., Boston Spa (England).
THE INTERACTION OF CONTACTING SOLID BODIES AND THE CALCULATION OF FRICTION AND WEAR
A. D. Lizarev, V. Sysoev, and E. F. Nepomnyashchy [1977] 44 p Transl. into ENGLISH from the Acad. of Sci., USSR (Moscow), 1971 p 117-125, Boston Spa, Engl. In ENGLISH and RUSSIAN
(BLL-M-24908-(5828.4F))

Mathematical relationships of friction and wear, as caused by a stream of hard spherical particles, were considered. Also investigated was the influence of tangential forces on deformations during the contact of a cylinder with a half space. B.L.P.

N78-14429 Stanford Univ., Calif.
AN ELASTO-PLASTIC MECHANISM FOR INVESTIGATION OF COLLAPSE AND COLLAPSE SUPPRESSION IN AXIALLY COMPRESSED, THIN, CIRCULAR CYLINDRICAL SHELLS Ph.D. Thesis
Ronald Phillip Nimmer 1977 178 p
Avail: Univ. Microfilms Order No. 77-18230

The elasto-plastic buckling and postbuckling of imperfect, thin, circular cylindrical shells in axial compression was studied with the use of a model. The model represents the shell as a mechanism of bars which are rigid in bending and twisting, connected at their end-points by hinges which offer finite resistance to bending and twisting deformations. The mechanism is specifically formulated to allow for the accurate representation of the Yoshimura collapse pattern associated with the large displacement postbuckling state of relatively thin shells. In addition to providing a computationally efficient means of studying the collapse of thin shells into the characteristic Yoshimura diamond pattern, the model is also capable of adequately representing the modified checkerboard displacement pattern associated with initial buckling and postbuckling of moderately thin shells. Dissert. Abstr.

N78-14430 Michigan Univ., Ann Arbor.
SOME STUDIES OF NONLINEAR DYNAMICS OF BEAMS Ph.D. Thesis
Metin Dede 1977 120 p
Avail: Univ. Microfilms Order No. 77-17978

A theoretical investigation of the nonlinear planar and nonplanar symmetric (snap-through) and nonsymmetric response and stability of an initially buckled beam was studied. The nonlinear effect due to axial stretching of the beam was introduced into the problem by the condition of immovable end supports. The nonlinear coupled partial differential equations describing the system were reduced to ordinary nonlinear coupled equations using Galerkin's method. The resulting coupled Duffing equations were solved using the harmonic balance method. The stability of response was analyzed by solving Hill-type equations, using Floquet theory. In regards to whirling motions, the effects of force level, beam geometry and initial buckling state were presented. It was found that planar motions are unstable to out-of-plane perturbations. It was concluded that whirling-type motion occurs even in the presence of the initial buckling state. Dissert. Abstr.

N78-14431 Virginia Polytechnic Inst. and State Univ., Blacksburg.
PROPAGATION OF DELAMINATION IN LAYERED ANISOTROPIC CYLINDERS Ph.D. Thesis
Ramaswamy Lakshminarayan Ramkumar 1976 179 p
Avail: Univ. Microfilms Order No. 77-20261

The propagation of delamination in a layered anisotropic cylinder was studied under different loading conditions. Initially, a closed form solution was obtained for an infinitely long cylinder by treating it as a thin shell, with an axisymmetric crack in the adhesive layer between two laminae, and an axisymmetric loading acting as the driving force. The axial and shear strains of the

reference plane were considered negligible compared to its circumferential strain. The cylinder, after delamination, was modelled as three shell elements joined at the crack tip. A sharp, flat crack up was assumed, and the slopes of the three shell elements at the crack tip were set to zero. The radial displacements of the three regions, obtained through the imposition of the proper boundary and matching conditions, were substituted into Clapeyron's theorem to obtain the total strain energy in the cylinder. Dissert. Abstr.

N78-14432 Vanderbilt Univ., Nashville, Tenn.
AN INVESTIGATION OF THE RELATIONSHIP BETWEEN THE STRESS INTENSITY FACTOR, CRACK TIP DISPLACEMENT, AND CLOSURE IN A TIME DEPENDENT MATERIAL Ph.D. Thesis
James Wayne Jones 1977 141 p
Avail: Univ. Microfilms Order No. 77-19379

A numerical analysis was performed for a viscoelastic material to determine time dependent crack surface displacements for a compact tension specimen configuration. A standard finite element approach was used to obtain elastic displacements. These displacements were employed in a numerical Laplace transform inversion procedure to obtain time dependent displacements. From the time dependent displacements, a modified Westergaard formation was utilized to obtain displacement determined stress intensity factors. Results from the numerical analysis indicate that the displacement determined stress intensity factor varies with time. The analysis was extended to predict the contribution of viscoelastic deformation in polymethylmethacrylate to the observed error in the dependence of the experimentally determined stress intensity factor on applied load. Dissert. Abstr.

N78-14433 Southern Methodist Univ., Dallas, Tex.
STRESS ANALYSIS OF DOUBLE-LAP JOINTS BONDED WITH A VISCOELASTIC ADHESIVE Ph.D. Thesis
Joyanto Kumar Sen 1977 293 p
Avail: Univ. Microfilms Order No. 77-18606

A finite element program was used to analyze the viscoelastic stress in a double lap joint bonded with a linear viscoelastic adhesive. Results were compared with photoelastic and photoviscoelastic measurements of the stresses and strains. The influences of the material and geometric parameters on the stresses and strains were investigated. The variations of stresses in the adhesive and adherends with respect to each of the parameters are presented graphically. The ratio of the adherend and adhesive moduli has the greatest influence on the stresses in the adhesive: the peak shear and tear stresses decrease with increase in this ratio. Of the geometric parameters, the overlap length influences most the magnitudes of the peak stresses in the adhesive. The joint can fail not only due to high stresses in the adhesive but also due to yielding of the adherends and high viscoelastic strain in the adhesive. A nondimensional quantity, the overlap ratio, is presented for use in predicting the stresses in the adhesive. Dissert. Abstr.

N78-14434 British Library Lending Div., Boston Spa (England).
BRITTLE FRACTURE INVESTIGATIONS INTO HEAT RESISTANT BOLT MATERIALS
K. Wellinger, A. Erker, K. H. Mayer, and R. Schaefer 1 Mar. 1977 36 p refs Transl. into ENGLISH from Vgb Krafswerk Technik (West Germany), no. 7, Jul. 1975 p 455-466 In GERMAN and ENGLISH
(BLL-ESB-Trans-628-(3810.97)) Avail: British Library Lending Div., Boston Spa, Engl.

Brittle fractures, which emerge from old cracks of different origin, occur even in the case of relatively cold loaded bolts. The cracks which were mainly found in the first load-bearing thread, were presumably caused by the thermal strains occurring during the starting of the steam power plant and by long-time stress. Cracks were much more seldom in the heat borings of the bolts which are reduced by improper warming during the prestressing of the bolts. The raw materials used in these bolts show a very low notch impact toughness at room temperature during the onset of damage. Data on the level of the nominal fracture stress of cracked bolts of normal size were obtained and compared with the notch impact toughness at 20 C, the FATT and NDT temperature, and the micro-fracto-graphical fracture picture of X 22 CrMoV 121, X 19 CrMoVNbN 111, and 21 CrMoV 511. Author

N78-14435 British Library Lending Div., Boston Spa (England).
CORRELATIONS OF DISC COMPRESSION, RING COMPRESSION AND BENDING STRENGTH WITH UNIAXIAL TENSILE STRENGTH OF METAL POWER COMPACTS
Kunio Okimoto, Tomio Sato, and Toshio Yamakawa 25 May 1977 24 p refs Transl. into ENGLISH from J. Jap. Soc. Powder Met. (Japan), v. 23, 1976 p 39-47 In JAPANESE and ENGLISH Presented at Spring Congr. of Jap. Soc. of Powder Met., Tokyo, Japan, May 1975
(BLL-NEL-TT-2713-(6075.461)) Avail: British Library Lending Div., Boston Spa, Engl.

The feasibility of using disc compression, ring compression, and bending tests was examined for estimating uniaxial tensile strength of metal powder compacts. The correlations of strengths and uniaxial tensile strength was also investigated. Experiments were carried out in uniaxial compression tests on metal powder compacts to study the relations among the strengths in terms of brittleness. B.B.

N78-14436# Northrop Corp., Hawthorne, Calif. Aircraft Div.
DEVELOPMENT AND EVALUATION OF METHODS OF PLANE STRESS FRACTURE ANALYSIS. PART 3. APPLICATION OF THE RESIDUAL STRENGTH PREDICTION TECHNIQUE TO COMPLEX AIRCRAFT STRUCTURE Final Report, Jan. - Jun. 1975
M. M. Ratwani and D. P. Wilhem Aug. 1977 156 p refs
(Contract F33615-72-C-1796)
(AD-A046151; NOR-75-86; AFFDL-TR-73-42-Pt-3) Avail: NTIS HC A08/MF A01 CSCL 20/11

Using the residual strength technique, uniaxially loaded, angle stiffened wing panels were analyzed and fracture strengths determined. Excellent correlation was obtained between experimental and analytical data for an initially intact and broken central stringer for a six bay aluminum panel with thin skin, a thick (0.193 inch) skin aluminum panel, and an all titanium panel. Both crack arrest and fracture could be predicted using the tangency conditions between the crack driving force curves (sq.rt. of (J) and the crack growth resistance curve (sq.rt. of J sub R). The influence of biaxial load ratio (tension fields) on crack opening displacement, plastic zone size and load transfer was examined for an all aluminum fuselage panel with a crack in the skin located normal to the longerons and parallel to the frames. Comparisons are made between analytical and experimental strain and residual strength data for biaxially loaded structure. GRA

N78-14437# Syracuse Univ., N. Y.
ELASTIC-PLASTIC DEFORMATION IN CRACKED SOLIDS AND DUCTILE FRACTURE CRITERION Final Report, 1 Jul. 1974 - 30 Jun. 1977
H. W. Liu, Wan-Liang Hu, and Sheng-Yi Kuo Sep. 1977 30 p refs
(Grants DAHC04-74-G-0165)
(AD-A045905; MTS-HWL-1611-FR-977; ARO-11961.5-E) Avail: NTIS HC A03/MF A01 CSCL 20/11

Linear elastic fracture mechanics have been very successful in dealing with brittle fractures of high strength and low and medium toughness materials. According to the conventional practice, a large specimen is required to measure the valid KIC value of a tough material. For a very tough material, the required specimen size could be too large for a typical laboratory testing machine to handle. Therefore, a new fracture criterion consistent with the basic principles of the linear elastic fracture mechanics is needed to measure high fracture toughness values. The development of the linear elastic fracture mechanics is based on the crack tip elastic stress and strain fields. A thorough understanding of the crack tip deformation and the crack tip stresses in the case of general yielding is necessary to develop a reliable ductile fracture theory. GRA

N78-14438# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
QUANTITATIVE DISPLACEMENT AND STRAIN DISTRIBUTION OF VIBRATING PLATE-LIKE STRUCTURES BASED ON TIME AVERAGE HOLOGRAPHIC INTERFEROMETRY

Final Report, 1 Oct. 1976 - 1 Jun. 1977
James C. MacBain Jul. 1977 102 p refs
(AD-A046153; AFAPL-TR-77-44) Avail: NTIS HC A06/MF A01 CSCL 20/11 .

A technique for computing the bending strain resulting from the resonant modal deformation of a vibrating plate-like structure is described. Interferometric fringes obtained by time-average holography are used as the basis for generating a mathematically continuous series approximation of the structure's out-of-plane displacement. The terms of the series consist of the eigenfunctions of a simple beam having either clamped-free or free-free boundary conditions. Use is made of a linear least squares equation solver to compute the coefficients of the displacement series terms based upon the experimental holographic fringe values. The technique is programmed for use on an interactive computer terminal. The method is tested by comparing it to the results of an eigenvalue analysis of a cantilevered plate analyzed using the finite element computer program, NASTRAN. Author (GRA)

N78-14439# Sandia Labs., Albuquerque, N. Mex.
ELASTIC-PLASTIC RESPONSE OF MILD STEEL BEAMS TO IMPULSE LOADS
M. J. Forrestal and D. L. Wesenbert May 1977 19 p refs
(Contract EY-76-C-04-0789)
(SAND-77-0783) Avail: NTIS HC A02/MF A01

Simply supported 1018 steel beams were loaded with half-sine distributed, short-duration magnetic pressure pulses and the response monitored with a streak camera and strain gages. A closed-form, elastic-viscoplastic approximate theory for peak displacement is derived and compared with measurements. Good agreement is shown between predictions and measurements.
ERA

N78-14440# Cornell Univ., Ithaca, N. Y. Dept. of Theoretical and Applied Mechanics.
CREEP OF CIRCULAR PLATES SEALING AN INCOMPRESSIBLE FLUID
K. J. Chang and R. H. Lance Apr. 1977 85 p refs
(Contract EY-76-S-02-2733)
(COO-2733-09) Avail: NTIS HC A05/MF A01

Creep of a symmetrically loaded clamped circular plate sealing an incompressible fluid is analyzed using a new constitutive relation for inelastic deformation behavior of metals. The problems are solved numerically for several cases at different temperatures and loading conditions. The salient features of the theory are critically examined. It is concluded that the results obtained are qualitatively similar to the results of creep reported in the literature. ERA

N78-14441# Stanford Research Inst., Menlo Park, Calif.
COMPUTATION OF CRACK PROPAGATION AND ARREST BY SIMULATING MICROFRACTURING AT THE CRACK TIP Final Report
D. A. Shockey, L. Seaman, and D. R. Curran Apr. 1977 56 p refs
(EPRI-NO-412) Avail: NTIS HC A04/MF A01

A model that describes the nucleation, growth, and coalescence of microfractures under dynamic loading conditions was used in computational simulations of a DCB crack arrest experiment. The energy absorbed in plastic deformation and in microfracturing of material at the tip of a propagating crack was calculated, and the results agreed well with the fracture toughness calculations made by more conventional although more indirect methods. Agreement between computed and observed crack velocity and arrest length was not good, but should improve when a finer mesh is used. This approach provides a link between micromechanical material response and continuum toughness parameters. ERA

N78-14442# Cornell Univ., Ithaca, N. Y. Dept. of Theoretical and Applied Mechanics.
DESIGN OF A UNIAXIAL LOAD CREEP TESTING MACHINE
K. J. Chang and R. H. Lance May 1977 44 p refs
(Contract EY-76-S-02-2733)
(COO-2733-10) Avail: NTIS HC A03/MF A01

The design of a uniaxial load creep machine for testing small scale metallic structures such as beams, plates and thin-walled cylinders is described. A special drum device introduced first by Hart is utilized to achieve step loading during creep tests. Some proof test results on four-point bending beams at room temperature are presented. It is noted that the specimen temperature can be controlled within a + or - 0.2 C fluctuation. Measurements of displacements exhibited creeplike behavior in the range of loads and times considered. ERA

N78-14443# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Strukturmechanik.
CALCULATING BUCKLING LOADS OF RING-STIFFENED CYLINDERS WITH STEPWISE VARYING WALL THICKNESS SUBJECTED TO EXTERNAL PRESSURE
M. Esslinger, H. Kerkhoff, and F. Meier May 1977 57 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(DLR-IB-152-77/14) Avail: NTIS HC A04/MF A01

A computer program was established to determine the buckling loads of circular cylinders subjected to axisymmetric loads. The cylinders may be stiffened by external or internal rings with rectangular cross sections. Provisions were made to account for discrete variations of the wall thickness including the effect of steps in the meridian. The program is based on Fluegge's shell theory and on Kalnin's solution procedure for the method of transfer matrices. It is assumed that a pure membrane state of stress exists in the shell prior to buckling. This simplifying assumption is advantageous as it leads to short computation time. Author (ESA)

N78-14444# Institut fuer Festkoerpermechanik, Freiburg (West Germany).
FRACTOGRAPHIC DETERMINATION OF DYNAMIC STRESS FACTORS IN PROPAGATING PULSE-LOADED CRACKS
T. Mueller, J. Beinert, and J. Kalthoff 1976 60 p refs In GERMAN; ENGLISH summary
(IFKM-WB-5/76) Avail: NTIS HC A04/MF A01

Dynamic stress intensity factors were determined for cracks loaded by short elastic pulses. A special fractographic method was developed for this from which the quantitative relationship between the angle of crack propagation and the dynamic and static stress intensity factors could be derived. A comparison of the measured dynamic stress intensity factors with the static values calculated using the usual static formulas and the schlierenoptically measured pulse stresses showed that the dynamic values were very much smaller than the static values. In the static calculation, however, neither the position- and time-dependence of the pulse stresses nor the variation in the loading on the crack were taken into account. Hence, a modified method of calculation was developed which allowed for the position- and time-dependence of the pulse stresses. This gave a very much better approximation to the dynamic stress intensity factors for loading with short pulses. The remaining difference between the calculated and the actual measured dynamic stress intensity factors arises from changes in the pulse loading due to diffraction and reflection effects at the crack. Both of these effects tend to reduce the load acting on the crack.
Author (ESA)

N78-14445# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
STRENGTH EVALUATION OF STEEL STRUCTURES FOR LOW-CYCLE FATIGUE
V. Grubisic and C. M. Sonsino Jan. 1977 51 p refs In GERMAN; ENGLISH summary Presented at the Conf. on Verhalten von Stahl bei Schwingender Beanspruchung, Aachen, 13-19 Feb. 1977
(LBF-TB-134(1977)) Avail: NTIS HC A04/MF A01

The basic aspects of elastoplastic materials behavior under cyclic loading at room temperature are discussed, and the use of low cycle fatigue and fracture mechanics data as fundamental material properties for pressure vessels is examined. Parameters affecting fatigue behavior of structural components are discussed and the procedure for service life prediction is described. ESA

N78-14446# Southampton Univ. (England). Inst. of Sound and Vibration Research.

[RESEARCH ACTIVITIES OF THE INSTITUTE OF SOUND AND VIBRATION RESEARCH] Annual Report for the year ending Mar. 1977
1977 43 p refs
Avail: NTIS HC A03/MF A01

Activities are reported in the following fields: fluid dynamics and acoustics, automotive noise, operational acoustics and audiology, structural dynamics, and industrial noise and condition monitoring. ESA

N78-14447# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
THE STIFFNESS IN COMPRESSION OF IMPERFECT ELASTICALLY RESTRAINED PLATE STRIPS AT VARIOUS IN-PLANE BOUNDARY CONDITIONS
A. VanderNeut Apr. 1977 19 p refs
(VTH-LR-245) Avail: NTIS HC A02/MF A01

The plate strips are loaded in compression, supported at their edges and elastically restrained against rotation, equally at the two edges. Solutions to two cases of in-plane boundary conditions, considered previously, are recapitulated and extended to include two more cases of in-plane boundary conditions. The imperfection and deflection were assumed to have the shape of the local buckling mode for arbitrary wavelength. The membrane stresses pertaining to these assumptions were solved rigorously. The Ritz-Galerkin conditions yield the relation of the strain-ratio, the load ratio, and the stiffness reduction factor to the wavelength parameter lambda, the coefficient of edge restraint C, the in-plane boundary conditions, and the imperfection parameter alpha. These solutions represent the exact value of the initial post-buckling behavior of the perfect plate and a close approximation of the behavior of imperfect plates, where the imperfection is small and the compressive strain is not beyond a small multiple of the local buckling strain. Author (ESA)

N78-14448# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
THE STRENGTH OF BOLTED JOINTS IN MULTI-DIRECTIONAL CFRP LAMINATES
T. A. Collings London Aeron. Res.Council 1977 74 p refs Supersedes RAE-TR-75127; ARC-36968
(ARC-CP-1380; RAE-TR-75127; ARC-36968) Avail: NTIS HC A04/MF A01: HMSO £3; PHI $11.60

Tests were carried out on simple bolted joints in multi-directional CFRP for a range of laminate configurations and hole sizes. For single-hole joints the various modes of failure were isolated and the corresponding strengths measured. The effects of variables such as ply orientation, laminate thickness and bolt clamping pressure are discussed in the light of the results. Multi-hole joints were designed using the single-hole data and test results show that for normal bolt spacings there is little interaction between holes. The results also show that the specific static strengths of these joints can be significantly better than those in conventional materials such as aluminum alloy and steel. Author (ESA)

N78-14449# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
APPLICATION OF FAILURE ANALYSIS IN AVIATION
E. A. B. DeGraaf 19 Jan. 1977 55 p refs In DUTCH; ENGLISH summary Presented at the Conf. on Non-Destructive Analysis, Twenthe, Neth., 13-14 Apr. 1977
(NLR-MP-77002-U) Avail: NTIS HC A04/MF A01

The role of service failure analysis in defining new inspection procedures and adapting existing ones is illustrated by case histories. It appears that in some cases this leads to a different design or choice of material. The examples, all taken from failure analyses conducted by the National Aerospace Laboratory NLR, include: failures detected during inspections prescribed by the manufacturer, failures discovered after having learned about the experience of other operators of the same type of aircraft, failures discovered after an accident, and failures discovered more or less by chance. Examples are also presented of supplementary investigations aimed at extending and improving the available techniques for service failure analysis. Author (ESA)

N78-14985# European Space Agency, Paris (France).
LOW FATIGUE CRACK PROPAGATION RATES OF ALUMINUM AND FOUR ALUMINUM ALLOYS
Guy Ramusat and Georges Vidal *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1976-5 (ESA-TT-405) Oct. 1977 p 16-30 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-5, Sep.-Oct. 1976 p 259-268 Original report in FRENCH previously announced as A77-16146 (For availability see N78-14983 05-99)
Avail: NTIS HC A06/MF A01

N78-14987# European Space Agency, Paris (France).
CLOSURE CONDITIONS IN THE CASE OF MULTICONNECTED SHELLS
Roger Valid *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1976-5 (ESA-TT-405) Oct. 1977 p 64-87 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-5, Sep.-Oct. 1976 p 289-299 Original report in FRENCH previously announced as A76-46362 (For availability see N78-14983 05-99)
Avail: NTIS HC A06/MF A01

N78-14189# European Space Agency, Paris (France).
CALCULATION OF AXISYMMETRIC MULTILAYER SHELLS BY THE FINITE ELEMENT METHOD
Daniel Engrand *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1976-6 (ESA-TT-406) Oct. 1977 p 70-89 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-6, Nov.-Dec. 1976 p 339-348 Original report in FRENCH previously announced as A76-47364 (For availability see N78-14184 05-31)
Avail: NTIS HC A06/MF A01

N78-14190# European Space Agency, Paris (France).
ADVANTAGE OF THE BENDING CRACK TEST FOR DETERMINING FATIGUE CRACK PROPAGATION LAWS
Georges Baudin, Jean Lemaitre, and Michel Robert *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1976-6 (ESA-TT-406) Oct. 1977 p 90-106 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-6, Nov.-Dec. 1976 p 349-358 Original report in FRENCH previously announced as A77-27022 (For availability see N78-14184 05-31)
Avail: NTIS HC A06/MF A01

N78-14994# European Space Agency, Paris (France).
MEASUREMENT AND CALCULATION OF THE CRACKING THRESHOLD AFTER OVERLOADINGS
Jacques Pellas, Georges Baudin, and Michel Robert *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-3 (ESA-TT415) Sep. 1977 p 125-155 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-3, May-Jun. 1977 p 191-204 Original report in FRENCH previously announced as A77-38746 (For availability see N78-14988 05-99)
Avail: NTIS HC A08/MF A01

42 GEOSCIENCES (GENERAL)

N78-14450 British Library Lending Div., Boston Spa (England).
THE NEED FOR SURFACE-BASED ACTINOMETRIC DATA, AND THE RATIONALIZATION OF THE SYSTEM OF ACTINOMETRIC OBSERVATIONS
N. P. Rusin and K. Ya. Vinnikov [1977] 27 p refs Transl. into ENGLISH from Ukr. Nauch.-Issled. Gidromet. Inst. (Kiev), 1974 p 14-25
(BLLD-M-24947-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

The uses of and needs for actinometric data were reviewed. Ground stations utilizing actinometers are able to estimate the earth's radiation and heat balance, investigate the law of the formation of physico-geographical zones, create a physical theory of climate, compute the water balance and estimate the evaporation from dry land and from water surfaces. Actinometric data are also useful in computing snow melt, the freezing of water bodies, illumination, plant photosynthesis, as well as thermal and energy effects on living and dead nature. Author

N78-14451# California Univ., Livermore. Lawrence Livermore Lab.
[BIBLIOGRAPHY OF EARTH SCIENCE REPORTS FOR 1976] Annual Report
B. Hornady and A. Duba 20 May 1977 85 p
(Contract W-7405-eng-48)
(UCID-17476-76) Avail: NTIS HC A05/MF A01

This compilation lists abstracts of papers, internal reports, and talks presented during 1976 at national and international meetings by members of the Earth Sciences Division, Lawrence Livermore Laboratory. Subjects include: coal gasification, gas stimulation, geothermal fields, oil shale retorting, radioactive waste management, geochemistry, geophysics, seismology, explosive phenomenology, and miscellaneous studies. ERA

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N78-14452* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
IN-SITU LASER RETORTING OF OIL SHALE Patent
Harvey S. Bloomfield, inventor (to NASA) Issued 6 Dec. 1977 5 p Filed 28 Jan. 1977 Supersedes N77-18429 (15 - 09, p 1176)
(NASA-Case-LEW-12217-1; US-Patent-4,061,190; US-Patent-Appl-SN-763753; US-Patent-Class-166-259; US-Patent-Class-166-248) Avail: US Patent Office CSCL 08I

Oil shale formations are retorted in situ and gaseous hydrocarbon products are recovered by drilling two or more wells into an oil shale formation underneath the surface of the ground. A high energy laser beam is directed into the well and fractures the region of the shale formation. A compressed gas is forced into the well that supports combustion in the flame front ignited by the laser beam, thereby ,retorting the oil shale. Gaseous hydrocarbon products which permeate through the fractured region are recovered from one of the wells that were not exposed to the laser system. Official Gazette of the U.S. Patent Office

N78-14453 British Library Lending Div., Boston Spa (England).
THE TRANSFER OF THE CONTENTS OF SATELLITE PICTURES ONTO GEOGRAPHIC MAPS
K. A. Zvonarev [1977] 11 p Transl. into ENGLISH from Vestnik: Ser. Geol. Geog. (Leningrad), v. 1, no. 6, 1976 p 104-114
(BLLD-M-24900-(5828.4F), BLLD-Trans-1287) Avail: British Library Lending Div., Boston Spa, Engl.

Techniques in using cartographic grids to transfer satellite photographs onto meteorology Mercator projections were studied. Formulae were derived for use in stereographic, azimuthal equiangular conical, and central projections. Relative accuracies were discussed for each map type. Author

N78-14454 California Univ., Los Angeles.
A STUDY OF BUOYANCY DRIVEN FLOWS IN ROTATING FLUIDS MOTIVATED BY PLANETARY APPLICATIONS Ph.D. Thesis
Charles Roger Carrigan 1977 199 p
Avail: Univ. Microfilms Order No. 77-19627

Properties of buoyancy driven flows resulting from instabilities of the basic state of a rotating fluid were investigated. The experimental and theoretical treatment emphasizes the linear aspects of such instabilities which occur under conditions that are dynamically and energetically similar to those conditions occurring in planetary interiors and in the atmospheres of stars when rotation is a dominating influence. Dissert. Abstr.

N78-14455*# Weyerhauser Co., Plymouth, N. C.
FOREST LAND MANAGEMENT BY SATELLITE: LANDSAT-DERIVED INFORMATION AS INPUT TO A FOREST INVENTORY SYSTEM
Darrel L. Williams (NASA. Goddard Space Flight Center) and Gerald F. Haver, Principal Investigators Dec. 1976 40 p Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS
(E78-10038; NASA-CR-155259) Avail: NTIS HC A03/MF A01 CSCL 02F

The author has identified the following significant results. Analysis of LANDSAT temporal data, specifically the digitally merged winter and summer scenes, provided the best overall classification results. Comparison of temporal classification results with available ground truth reveal a 94% agreement in the delineation of hardwood categories, a 96% agreement for the combined pine category, and a greater than 50% agreement for each individual pine subcategory. For nearly 1000 acres, compared clearcut acreage estimated with LANDSAT digital data differed from company inventory records by only 3%. Through analysis of summer data, pine stands were successfully classified into subcategories based upon the extent of crown closure. Maximum spectral separability of hardwood and pine stands was obtained from the analysis of winter data.

N78-14456*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
PROCEDURE B: A MULTISEGMENT TRAINING SELECTION AND PROPORTION ESTIMATION PROCEDURE FOR PROCESSING LANDSAT AGRICULTURAL DATA Final Report, 15 May 1976 - 14 Nov. 1977
Richard F. Nalepka, Principal Investigator, R. J. Kauth, and W. Richardson Nov. 1977 143 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. EREP
(Contract NAS9-14988)
(E78-10039; NASA-CR-151576; ERIM-122700-31-F) Avail: NTIS HC A07/MF A01 CSCL 02F

There are no author-identified significant results in this report.

N78-14457*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
SIGNATURE EXTENSION PREPROCESSING FOR LANDSAT MSS DATA Final Report, 15 May 1976 - 14 Nov. 1977
Richard F. Nalepka, Principal Investigator and Peter F. Lambeck Nov. 1977 69 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. EREP
(Contract NAS9-14988)
(E78-10040; NASA-CR-151563; ERIM-122700-32-F) Avail: NTIS HC A04/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N78-14458*# Norwegian Water Resources and Electricity Board, Oslo.
APPLICATION OF LANDSAT IMAGERY FOR SNOW MAPPING IN NORWAY Final Report, 16 May 1975 - 27 Aug. 1976
Helge Odegaard and Johnny E. Skorve, Principal Investigators 25 May 1977 29 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS
(E78-10041; NASA-CR-155341) Avail: NTIS HC A03/MF A01 CSCL 08L

The author has identified the following significant results. During the summer seasons of 1975 and 1976, the snow cover was successfully monitored and measured in the four basins. By using elevation distributions for these basins combined with the measured snow cover percentages, the equivalent snow line altitude was calculated. Equivalent snow line altitude was used in accordance with Mark Meier's definition. Cumulative runoff data were collected for the basins. Tables showing percentage snow cover versus cumulative runoff were worked out for 1975.

N78-14459*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
AGRICULTURAL SCENE UNDERSTANDING Final Report
D. A. Landgrebe, Principal Investigator, Marvin E. Bauer, LeRoy Silva, Roger M. Hoffer, and Marion F. Baumgardner Nov. 1977 184 p refs Original contains imagery. Original photography

may be purchased from the EROS Data Center, Sioux Falls, S. D. EREP
(Contract NAS9-14970)
(E78-10043; NASA-CR-155343; LARS-112677; T-1314/4; MA-129TA) Avail: NTIS HC A09/MF A01 CSCL 02C

The author has identified the following significant results. The LACIE field measurement data were radiometrically calibrated. Calibration enabled valid comparisons of measurements from different dates, sensors, and/or locations. Thermal band canopy results included: (1) Wind velocity had a significant influence on the overhead radiance temperature and the effect was quantized. Biomass and soil temperatures, temperature gradient, and canopy geometry were altered. (2) Temperature gradient was a function of wind velocity. (3) Temperature gradient of the wheat canopy was relatively constant during the day. (4) The laser technique provided good quality geometric characterization.

N78-14460*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
TEST OF SPECTRAL/SPATIAL CLASSIFIER Final Report
D. A. Landgrebe, Principal Investigator, J. L. Kast, and B. J. Davis Nov. 1977 168 p refs EREP
(Contract NAS9-14970)
(E78-10044; NASA-CR-155344; LARS-112877; T-1314/4; MA-129TA) Avail: NTIS HC A08/MF A01 CSCL 05B

The author has identified the following significant results. The supervised ECHO processor (which utilizes class statistics for object identification) successfully exploits the redundancy of states characteristic of sampled imagery of ground scenes to achieve better classification accuracy, reduce the number of classifications required, and reduce the variability of classification results. The nonsupervised ECHO processor (which identifies objects without the benefit of class statistics) successfully reduces the number of classifications required and the variability of the classification results.

N78-14461*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
PROCESSING TECHNIQUES DEVELOPMENT Final Report
D. A. Landgrebe, Principal Investigator, B. J. Davis, T. L. Phillips, C. R. Sand, and P. E. Anuta Nov. 1977 57 p refs EREP
(Contract NAS9-14970)
(E78-10045; NASA-CR-155345; LARS-112777; T-1314/4; MA-129TA) Avail: NTIS HC A04/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N78-14462*# Environmental Research Inst. of Michigan, Ann Arbor.
INVESTIGATION OF TECHNIQUES FOR INVENTORYING FORESTED REGIONS. VOLUME 1: REFLECTANCE MODELING AND EMPIRICAL MULTISPECTRAL ANALYSIS OF FOREST CANOPY COMPONENTS Final Report, 15 May 1976 - 14 Nov. 1977
Richard F. Nalepka, Principal Investigator, F. G. Sadowski, and W. A. Malila Nov. 1977 80 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. EREP
(Contract NAS9-14988)
(E78-10046; NASA-CR-151561; ERIM-122700-35-F1-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 02F

The author has identified the following significant results. Effects of vegetation density on overall canopy reflectance differed dramatically, depending on spectral band, base material, and vegetation type. For example, reflectance changes caused by variations in vegetation density were hardly apparant for a simulated burned surface in LANDSAT band 5, while large changes occurred in band 7. When increasing densities of tree overstory were placed over understories, intermediate to dense overstories effectively masked the understories and dominated the spectral signatures. Dramatic changes in reflectance occurred for canopies placed on a number of varying topographic positions. Such changes were seen to result in the spectral overlap of some nonforested with densely forested situations.

N78-14463*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
INVESTIGATION OF TECHNIQUES FOR INVENTORYING FORESTED REGIONS. VOLUME 2: FORESTRY INFORMATION SYSTEM REQUIREMENTS AND JOINT USE OF REMOTELY SENSED AND ANCILLARY DATA Final Report, 14 May 1976 - 14 Nov. 1977
Richard F. Nalepka, Principal Investigator, Richard C. Cicone, William A. Malila, and Eric P. Crist Nov. 1977 145 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. EREP
(Contract NAS9-14988)
(E78-10047; NASA-CR-151575; ERIM-122700-35-F2-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 02F

The author has identified the following significant results. Effects of terrain topography in mountainous forested regions on LANDSAT signals and classifier training were found to be significant. The aspect of sloping terrain relative to the sun's azimuth was the major cause of variability. A relative insolation factor could be defined which, in a single variable, represents the joint effects of slope and aspect and solar geometry on irradiance. Forest canopy reflectances were bound, both through simulation, and empirically, to have nondiffuse reflectance characteristics. Training procedures could be improved by stratifying in the space of ancillary variables and training in each stratum. Application of the Tasselled-Cap transformation for LANDSAT data acquired over forested terrain could provide a viable technique for data compression and convenient physical interpretations.

N78-14464*# Environmental Research Inst. of Michigan, Ann Arbor. Center for Remote Sensing Information and Analysis.
PROCEEDINGS OF THE ELEVENTH INTERNATIONAL SYMPOSIUM ON REMOTE SENSING OF ENVIRONMENT, VOLUME 1
1977 832 p refs Proc. held at Ann Arbor, Mich., 25-29 Apr. 1977; sponsored by FHA, NOAA, Geological Survey, Dept. of Agriculture, Army Res. Center, TVA, Coast Guard, NASA, ERDA, and EPA Original contains color illustrations
(NASA-CR-155361) Avail: NTIS HC A99/MF A01 CSCL 05B

The application of modern sensor technology and associated data processing capabilities to the assessment of earth resources and environmental monitoring is described. Problems associated with meeting future needs are explored. For individual titles, see N78-14465 through N78-14528.

N78-14465*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SENSING THE EARTH'S ENVIRONMENT FROM SPACE: USER NEEDS AND TECHNOLOGY OPPORTUNITIES
Robert G. Nagler *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 35-50 refs (For availability see N78-14464 05-43)
(Contract NAS7-100)
Avail: NTIS HC A99/MF A01 CSCL 04B

The specific measurements and data needs of users of remotely sensed environmental data were identified in a number of studies supported by NASA in cooperation with industry, universities, and the operational government agencies involved. The present capabilities of space and aircraft sensors, data systems, and satellite support systems were assessed and compared with the trends in the supporting technology. Areas of high benefit in which there is a large gap between the efforts underway and the need are identified. The problems in narrowing these gaps are briefly discussed. Author

N78-14466*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TECHNOLOGY ADVANCES IN ACTIVE AND PASSIVE MICROWAVE SENSING THROUGH 1985
Frank T. Barath *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 51-54 refs (For availability see N78-14464 05-43)
(Contract NAS7-100)
Avail: NTIS HC A99/MF A01 CSCL 17E

The capabilities of passive and active microwave sensors are discussed. The Nimbus-G and Seasat-A scanning multichannel microwave spectrometer, the Seasat-A radar altimeter, scatterometer and synthetic aperture radar represent the first systematic attempt at exploring a wide variety of applications utilizing microwave sensing techniques and are indicators of the

directions in which the pertinent technology is likely to evolve. The trend is toward high resolution multi-frequency imagers spanning wide frequency ranges and wide swaths requiring sophisticated receivers, real-time data processors and most importantly, complex antennas. Author

N78-14467*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE UTILITY OF SHORT WAVELENGTH (>1mm) REMOTE SENSING TECHNIQUES FOR THE MONITORING AND ASSESSMENT OF HYDROLOGIC PARAMETERS

A. Rango and V. Salomonson *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 55-66 refs (For availability see N78-14464 05-43)

Avail: NTIS HC A99/MF A01 CSCL 08H

Remote sensing programs that respond to the requirements of the water resources management and hydrologic communities are reviewed. The major areas where the needs of water resources management are being met involve the mapping and monitoring of snowcovered areas, hydrologic landuse, and surface water area. In the case of snowcovered area mapping the transfer of technology process is now being accomplished in the Western United States in a cooperative effort involving 6 federal agencies and 3 state agencies along with NASA. A new collaborative effort of the U.S. Army Corps of Engineers and NASA involves the mapping of landuse by Landsat and its use in hydrologic engineering watershed models employed in flood control/ waterworks planning, design, and management. Improved systems planned for implementation in the 1978-1981 time frame can be expected to result in increased utilization of visible and near infrared remote sensing observations. Author

N78-14468*# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.

MICROWAVE REMOTE SENSING OF HYDROLOGIC PARAMETERS

Fawwaz T. Ulaby *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 67-86 refs (For availability see N78-14464 05-43)

Avail: NTIS HC A99/MF A01 CSCL 08H

A perspective on the implementation of microwave sensors in future airborne and spaceborne observations of hydrologic parameters is presented. The rationale is based on a review of the status and future trends of active (radar) and passive (radiometer) microwave research as applied to the remote sensing of soil moisture content, snowpack water equivalent, freeze/thaw boundaries, lake ice thickness, surface water area, and the specification of watershed runoff coefficients. Analyses and observations based on data acquired from ground based, airborne and spaceborne platforms, and an evaluation of advantages and limitations of microwave sensors are included. Author

N78-14469*# Maryland Univ., College Park. Dept. of Civil Engineering.

UTILIZATION OF REMOTE SENSING OBSERVATIONS IN HYDROLOGIC MODELS

Robert M. Ragan *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 87-99 refs (For availability see N78-14464 05-43)

Avail: NTIS HC A99/MF A01 CSCL 08H

Most of the remote sensing related work in hydrologic modeling has centered on modifying existing models to take advantage of the capabilities of new sensor techniques. There has been enough success with this approach to insure that remote sensing is a powerful tool in modeling the watershed processes. Unfortunately, many of the models in use were designed without recognizing the growth of remote sensing technology. Thus, their parameters were selected to be map or field crew definable. It is believed that the real benefits will come through the evolution of new models having new parameters that are developed specifically to take advantage of our capabilities in remote sensing. The ability to define hydrologically active areas could have a significant impact. The ability to define soil moisture and the evolution of new techniques to estimate evoportransportation could significantly modify our approach to hydrologic modeling. Still, without a major educational effort to develop an understanding of the techniques used to extract parameter estimates from remote sensing data, the potential offered by this new technology will not be achieved. Author

N78-14470*# California Univ., Santa Barbara. Dept. of Geography.

THE IMPACT OF REMOTE SENSING ON UNITED STATES' GEOGRAPHY: THE PAST IN PERSPECTIVE, PRESENT REALITIES, FUTURE POTENTIALS

John E. Estes, John R. Jensen, and David S. Simonett *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 101-121 refs (For availability see N78-14464 05-43)

Avail: NTIS HC A99/MF A01 CSCL 08F

The use of remotely sensed data by cartographers and other physical geographers is reviewed. The current status of remote sensing in the academic, governmental, and private sector is assessed, as well as its capability for providing information within the context of the explanatory forms used by geographers.

A.R.H.

N78-14471*# Environmental Research Inst. of Michigan, Ann Arbor.

REMOTE SENSING DATA PROCESSING: TWO YEARS AGO, TODAY, AND TWO YEARS FROM TODAY

Quentin A. Holmes, David Goodenough (Canada Centre for Remote Sensing, Ottawa), and Jon D. Erickson (NASA. Johnson Space Center) *In its* Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 125-135 refs (For availability see N78-14464 05-43)

Avail: NTIS HC A99/MF A01 CSCL 08F

Beginning with a survey of the state-of-the-art of processing remotely sensed data in early 1975, significant developments between that time and the present are chronicled, and technologies for early 1979 are projected. Current technical issues discussed include: training selection and labeling; classification and mensuration; use of satellite indicators to supplement predictions; small scale field structures; physical factors; ancillary data; geometric quality; and the cost of processing. Author

N78-14472*# Environmental Research Inst. of Michigan, Ann Arbor.

A SURVEY OF SAR IMAGE-FORMATION PROCESSING FOR EARTH RESOURCES APPLICATIONS

Robert W. Bayma, Rolando L. Jordan (JPL), and Bob N. Manning (Goodyear Aerospace Corp., Litchfield Park, Ariz.) *In its* Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 137-159 refs (For availability see N78-14464 05-43)

Avail: NTIS HC A99/MF A01 CSCL 17I

Currently there is considerable interest in active microwave sensors for earth resources applications, such as the SEASAT-A radar. However, to obtain spatial resolutions comparable to optical sensors at radar frequencies, sophisticated image formation processing techniques must be applied to the raw data. Processing requirements for non-coherent optical and coherent radar imaging systems are compared. The image formation processing requirements for synthetic aperture radar (SAR) systems are discussed. Both optical and digital techniques are addressed, and examples of hardware and imagery for each processing technique are presented. Author

N78-14473*# California Univ., Santa Barbara. Dept. of Geography.

A PERSPECTIVE ON THE STATE OF THE ART OF PHOTOGRAPHIC INTERPRETATION

John E. Estes *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 161-177 refs (For availability see N78-14464 05-43)

Avail: NTIS HC A99/MF A01 CSCL 14E

Aerial photography and photographic interpretation are the cornerstone of remote sensing. Many interpretative techniques used on data from these more advanced or unconventional imaging systems are essentially extensions of techniques originally developed for the analysis of aerial photographic data. As research on the analysis and application of data from other than photographic imaging systems progresses, the role of the interpretation of aerial photography becomes more important. Any individual who wishes to practice the art of remote sensing

data analysis must gain a thorough knowledge of the activities, elements and techniques of manual photographic/image interpretation. While the activities and elements of photo interpretation have remained essentially the same, technique development has continued to progress. Additional studies are proposed dealing with the basics of interactive processes. Author

N78-14474*# Geosat Committee, Inc., San Francisco, Calif.
INDUSTRIAL USE OF GEOLOGICAL REMOTE SENSING FROM SPACE
Frederick B. Henderson, III *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 183-187 (For availability see N78-14464 05-43)
Avail: NTIS HC A99/MF A01 CSCL 08G

NASA's remote sensing technology as exemplified by ERTS-1 and LANDSAT 2 developed far more rapidly than they could have been reasonably absorbed with proved results by geological industries. This under-utilization of available technology is due to the ingrown infrastructure of exploration and engineering programs and techniques, and the inherent indirectness and long term effectiveness of the application of remote sensing to geological needs. The value of four dimensional geologic maps and the capabilities of various sensors are discussed. Author

N78-14475*# National Environmental Satellite Service, Washington, D. C.
METEOROLOGICAL SENSORS AND RELATED TECHNOLOGY FOR THE EIGHTIES
E. L. Heacock *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 189-199 (For availability see N78-14464 05-43)
Avail: NTIS HC A99/MF A01 CSCL 04B

The sensors currently projected for the new generation of meteorological satellites which will be in operation during the First Global Atmospheric Research Program [GARP] Global Experiment (FGGE) are described. The closely related subject of on-board data processing is treated briefly as well as efforts by the countries/agencies responsible for these satellites to make useful products available to developing countries at low cost. Author

N78-14476*# National Environmental Satellite Service, Washington, D. C.
OPERATIONAL DATA PROCESSING: THE FIRST TEN YEARS ARE THE HARDEST
John A. Leese and Charles L. Bristor *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 201-219 refs (For availability see N78-14464 05-43)
Avail: NTIS HC A99/MF A01 CSCL 05B

A historical perspective of operational data processing and its development in the National Environmental Satellite Service is presented. The types of sensor data to be used in operational data processing are specified through the time period of the 1980's. Features that are essential for the design and implementation of a good data base system are outlined. Realistic standards for optimal data productions are discussed. Author

N78-14477*# National Weather Service, Silver Spring, Md.
OPERATIONAL UTILIZATION OF REMOTELY SENSED DATA
James B. Jones *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 221-228 (For availability see N78-14464 05-43)
Avail: NTIS HC A99/MF A01 CSCL 05B

The use of data from environmental satellites and other remote sensing platforms in some of NOAA's operational services are described. Topics discussed include: hurricanes; severe local storms and tornadoes; forest guidance; weather forecasting; hydrology; space program support; oceanography; search and rescue; and wildlife management. Applications which have become routine, and those which are in advanced field test are included. Some applications yield a clear cut economic benefit. In other cases, benefits -- if any -- are obscure. In yet other cases, benefits in one sector may be offset by detriments in another. Illustrative examples are given. Author

N78-14478*# Interior Dept., Washington, D.C.
REBIRTH OF REMOTE SENSING: DO WE KNOW ENOUGH FOR OUR OWN GOOD?
Robert L. Herbst *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 229-235 (For availability see N78-14464 05-43)
Avail: NTIS HC A99/MF A01 CSCL 05B

Obstacles or deficiencies in on-going satellites that impede operational use of data are described. Because spectral and spatial characteristics of LANDSAT D sensors are different from earlier satellites, they deter operational planning and data use, and an operational program operated in parallel with experimental technology development is needed. Particular attention is given to the satellite sensor readout system, its current applications, and needs for the future. A.R.H.

N78-14479*# Environmental Research Inst. of Michigan, Ann Arbor.
GATHERING AND USING INFORMATION ON A GLOBAL SCALE
Charles W. Mathews *In its* Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 237-241 (For availability see N78-14464 05-43)
Avail: NTIS HC A99/MF A01 CSCL 05B

The importance of information gathered, integrated and analyzed over broad regions of the world is discussed. Means of acquiring information on critical areas are outlined, and the particular role that remote sensing can play is described in each case. The possible implementation of a global information system and some of the current difficulties in initiation of such a system on an operational basis are explored. In this way, issues will be surfaced for consideration. Topics include: the importance of innovative leadership, and some actions that the government might take, both in Congress and in the Executive Branch; the relationship of U.S. government activities to international interests and to industry; and the need to stimulate more private sector initiative and to transfer responsibilities from government to commercial interests. Author

N78-14480*# Agency for International Development, Washington, D.C.
US INITIATIVES FOR REMOTE SENSING APPLICATIONS IN THE DEVELOPING WORLD
John K. Wilhelm *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 243-246 (For availability see N78-14464 05-43)
Avail: NTIS HC A99/MF A01 CSCL 05B

Efforts of the Agency for International Development to stimulate interest in remote sensing and the use of operational data are described. A.R.H.

N78-14481*# International Astronautical Federation, Paris (France).
THE PRESENT STATUS OF REMOTE SENSING IN THE UNITED NATIONS, 8 APRIL 1977
Eilene Galloway *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 247-256 refs (For availability see N78-14464 05-43)
Avail: NTIS HC A99/MF A01 CSCL 05B

Problems arising from remote sensing of the earth by satellites have been the subject of indepth research and analysis by the United Nations. Every aspect of this multidisciplinary subject has been explored in more than 100 reports and papers published as UN documents dealing with all the implications of remote sensing: scientific, technological, institutional, political, economic, cultural, and legal. National, regional and international situations have been analyzed, and the General Assembly has passed resolutions requesting that the Committee on the Peaceful Uses of Outer Space give a high priority to remote sensing. The identification and analysis of issues has been going on for several years, the objective being international agreement on general principles to guide nations in the conduct of their remote sensing activities. Author

N78-14482*# South Dakota State Univ., Brookings. Remote Sensing Inst.
PROGRESS AND NEEDS IN AGRICULTURAL RESEARCH, DEVELOPMENT, AND APPLICATIONS PROGRAMS
D. G. Moore and V. I. Myers *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977

p 257-266 refs (For availability see N78-14464 05-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The dynamic nature of agriculture requires repetitive resource assessments such as those from remote sensing. Until recently, the use of remote sensing in agriculture has been limited primarily to site specific investigations without large-scale evaluations. Examples of successful applications at various user levels are provided. The stage of development for applying remote sensing to many agricultural problems is assessed, and goals for planning future data characteristics for increased use in agriculture are suggested. Author

N78-14483*# Canadian Forestry Service, Ottawa (Ontario).
REMOTE SENSING AND TODAY'S FORESTRY ISSUES
L. Sayn-Wittgenstein *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 267-276 refs (For availability see N78-14464 05-43)
Avail: NTIS HC A99/MF A01 CSCL 02F

The actual and the desirable roles of remote sensing in dealing with current forestry issues, such as national forest policy, supply and demand for forest products and competing demands for forest land are discussed. Topics covered include wood shortage, regional timber inventories, forests in tropical and temperate zones, Skylab photography, forest management and protection, available biomass studies, and monitoring. Author

N78-14484*# National Environmental Satellite Service, Washington, D. C.
CURRENT AND FUTURE SATELLITES FOR OCEANIC MONITORING
John W. Sherman, III *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 279-297 refs (For availability see N78-14464 05-43)
Avail: NTIS HC A99/MF A01 CSCL 08C

Current applications and products from existing operational satellites, are reviewed. The future data and information that will become available before the end of this decade are described with emphasis on global oceanic data. Author

N78-14485*# Geological Survey, Reston, Va.
COASTAL WETLANDS: THE PRESENT AND FUTURE ROLE OF REMOTE SENSING
Virginia Carter *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 301-323 refs (For availability see N78-14464 05-43)
Avail: NTIS HC A99/MF A01 CSCL 08C

During the past decade, there has been a rapid expansion of remote sensing research and technology development related to coastal wetlands. As a result of this research, all of the 23 coastal states have ongoing or completed wetland inventories, most utilizing aerial photographs as the data source for producing a variety of map products with varying scales, formats, classification systems and intended uses. The U.S. Geological Survey is increasing emphasis on map production and revision for the coastal zone. The new U.S. Fish and Wildlife Service National Wetland Inventory is intended to provide a standardized method for comparison of wetlands on a national basis - it too will use available aerial photographs as a basic data source. At present, satellite data is not used for operational mapping of coastal wetlands because of resolution and geometric constraints. In the future, however, satellite data may provide an accurate reliable and economical source to update wetland inventories and to monitor or evaluate coastal wetlands. The technological improvements accompanying the development and launch of Landsat C and D and the space shuttle promise to make satellite digital data a more powerful tool to supply information for future management decisions for coastal wetlands. Author

N78-14486*# Geological Survey, Sioux Falls, S. Dak.
AN OVERVIEW OF REMOTE SENSING TECHNOLOGY TRANSFER IN CANADA AND THE UNITED STATES
W. M. Strome (Canada Centre for Remote Sensing.) and D. T. Lauer *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 325-331 refs (For availability see N78-14464 05-43)
Avail: NTIS HC A99/MF A01 CSCL 05B

To realize the maximum potential benefits of remote sensing, the technology must be applied by personnel responsible for the management of natural resources and the environment. In Canada and the United States, these managers are often in local offices and are not those responsible for the development of systems to acquire, preprocess, and disseminate remotely sensed data, nor those leading the research and development of techniques for analysis of the data. However, the latter organizations have recognized that the technology they develop must be transferred to the management agencies if the technology is to be useful to society. Problems of motivation and communication associated with the technology transfer process, and some of the methods employed by Federal, State, Provincial, and local agencies, academic institutions, and private organizations to overcome these problems are explored. Author

N78-14487*# United Nations, New York.
TECHNICAL ASSISTANCE AND THE TRANSFER OF REMOTE SENSING TECHNOLOGY
Ralph Chipman *In* ERIM Proc. of the 11th intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 333-338 refs (For availability see N78-14464 05-43)
Avail: NTIS HC A99/MF A01 CSCL 05B

The transfer of technology from industrialized countries to the third world is a very complicated process and one that requires a great deal of research and development. The political and social obstacles to this transfer are generally greater than the technical obstacles, but technical assistance programs have neither the competence nor the inclination to deal with these factors adequately. Funding for technical assistance in remote sensing is now expanding rapidly, and there is a growing need for institutions to study and promote the effective use of this technology for economic development. The United Nations, the Food and Agriculture Organization, the World Bank, the United States Agency for International Development and the Canadian technical assistance agencies take different approaches to the problem and deal with the political pressures in different ways. Author

N78-14488*# Ife Univ., Ile-Ife (Nigeria). Dept. of Agriculture Engineering.
THE TRANSFER OF REMOTE SENSING TECHNOLOGY IN THE DEVELOPING NATIONS: AN OBSERVATION
Adigun Ade Abiodun *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 339-351 refs (For availability see N78-14464 05-43)
Avail: NTIS HC A99/MF A01 CSCL 05B

The cooperation and assistance of industrialized nations and the United Nations and its agencies in promoting the transfer of remote sensing technology in developing nations was discussed. Training programs, workshops, and seminars as well as on-going globally scattered demonstration projects were evaluated and it was suggested that emphasis should shift from centralized training to scheduled regional training programs, resulting in larger local participation and on-the-spot application of the technology to solve local problems. Author

N78-14489*# Environmental Protection Agency, Las Vegas, Nev. Environmental Monitoring and Support Lab.
REMOTE SENSING OF AIR POLLUTANTS
J. A. Eckert and R. B. Evans *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 353-359 refs (For availability see N78-14464 05-43)
Avail: NTIS HC A99/MF A01 CSCL 13B

Monitoring of pollutants within the troposphere is discussed. Selected specific techniques were investigated and it was shown how the use of these techniques fits into the overall national strategy for air pollution abatement. Author

N78-14490*# Agency for International Development, Washington, D.C.
REMOTE SENSING OF ENVIRONMENTAL IMPACT OF LAND USE ACTIVITIES
C. K. Paul *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 363-377 refs (For availability see N78-14464 05-43)
Avail: NTIS HC A99/MF A01 CSCL 08B

The capability to monitor land cover, associated in the past with aerial film cameras and radar systems, was discussed in regard to aircraft and spacecraft multispectral scanning sensors.

A proposed thematic mapper with greater spectral and spatial resolutions for the fourth LANDSAT is expected to usher in new environmental monitoring capability. In addition, continuing improvements in image clasification by supervised and unsupervised computer techniques are being operationally verified for discriminating environmental impacts of human activities on the land. The benefits of employing remote sensing for this discrimination was shown to far outwweigh the incremental costs of converting to an aircraft-satellite multistage system. Author

N78-14491*# Federal Highway Administration, Washington, D.C.
THE ROLE OF REMOTE SENSING IN THE BUILDING OF THE INTERSTATE HIGHWAY SYSTEM
Harold T. Rib *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 379-383 refs (For availability see N78-14464 05-43)
Avail: NTIS HC A99/MF A01 CSCL 13B

The construction of 68,397 km of interstate highways in the United States, initiated 20 years ago, was examined in regard to remote sensing techniques used. Many of the tools utilized today to locate and design highways were unknown when the program was begun. An overview is presented of the changing role remote sensing has played and continues to play in this vast project. Author

N78-14492*# Tennessee Valley Authority, Chattanooga. Mapping Services Branch.
REMOTE MONITORING AND TENNESSEE VALLEY AUTHORITY PROGRAMS
Alan R. Stevens and Alan W. Voss *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 385-392 (For availability see N78-14464 05-43)
Avail: NTIS HC A99/MF A01 CSCL 05A

The Tennessee Valley Authority was created in 1933 as a resource development agency and was charged with the basic mission of improving the economy of a depressed region through power production, flood control, and navigation. Those programs which availed themselves of remotely monitored data, either directly or indirectly supporting this mission, were examined. Author

N78-14493*# Army Engineer Topographic Labs., Fort Belvoir, Va.
CORPS OF ENGINEERS APPLICATIONS FOR REMOTE SENSING OF THE ENVIRONMENT
Maurice K. Kurtz, Jr. and John W. Jarman *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 393-399 (For availability see N78-14464 05-43)
Avail: NTIS HC A99/MF A01 CSCL 13B

An objective overview is presented of the application of remote sensing technology in the Corps of Engineers. Examples are given of attempts to use the current state of the art to achieve particular disciplinary or mission oriented goals. The Corps, presently engaged in both research and development and technology transfer, has encountered some interesting situations. Practical operational utilization depends not only on technology, but also economic benefit/cost factors and some unprecedented legal, political, and social issues. Yet, at a time when increased agency commitment to operational usage is being sought, an assessment of the state of the art reveals that sensor technology, data processing and analysis, and models still require further development. There is a challenge in synchronizing technology push with the demand pull of dimly perceived user needs. They should complement each other rather than oppose. The goal is to use the combined push-pull effect to lead to increased productivity and responsiveness by the Corps. Author

N78-14494*# Massachusetts Inst. of Tech., Cambridge. Dept. of Electrical Engineering and Computer Science.
ATMOSPHERIC SOUNDING WITH PASSIVE MICROWAVES: REVIEW AND PROGNOSIS
David H. Staelin *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 401-406 refs (For availability see N78-14464 05-43)
(Contracts NAS5-21980; NAS5-23677)
Avail: NTIS HC A99/MF A01 CSCL 04A

Global maps of temperature profiles from 0 to 20 km altitude and of total water vapor and liquid water over the ocean were obtained from satellite-borne microwave spectrometers. Future satellites will extend the altitude range above 100 km and permit monitoring of H2O, O3, CO, N2O, and other trace constituents. Operational microwave temperature sounding spectrometers are scheduled for launch on both military and civilian U.S. satellites, and future improvements can be expected. Author

N78-14495*# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
SPACE RADAR SYSTEM SPECIFICATIONS
F. T. Ulaby, T. F. Bush, and W. H. Stiles *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 407-425 refs (For availability see N78-14464 05-43)
Avail: NTIS HC A99/MF A01 CSCL 17I

System specifications are proposed for an imaging radar whose primary objective is to provide useful information for land applications including hydrology, agriculture and geology. Author

N78-14496*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LACIE: A LOOK TO THE FUTURE
R. B. MacDonald and F. G. Hall *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 429-465 refs (For availability see N78-14464 05-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The Large Area Crop Inventory Experiment (LACIE) is a project designed to demonstrate the applicability of remote sensing technology to monitor globally an important world food crop - wheat. The need for more timely and reliable monitoring of food and fiber supplies is discussed, and the monitoring systems currently utilized are reviewed. The fundamentals involved in assessing the impact of variable weather and economic conditions on wheat acreage, yield, and production are elucidated. The experiment's approach to production monitoring is described, and its status is reviewed. Examples of acreage and yield monitoring in the Soviet Union are used to illustrate the experiment's approach. Author

N78-14497*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ENERGY AND REMOTE SENSING
R. A. Summers (ERDA, Washington, D. C.), W. L. Smith (ERIM), and N. M. Short *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 467-481 refs (For availability see N78-14464 05-43)
Avail: NTIS HC A99/MF A01 CSCL 10B

Effective implementation of the President's National Energy Plan and the Nuclear Power Policy Statement require application of the best remote sensing tools available. The potential contributions of remote sensing, particularly LANDSAT data, have yet to be clearly identified and exploited. These contributions investigated fall into the following categories: (1) exploration; (2) exploitation; (3) power plant siting; (4) environmental assessment and monitoring; and (5) transportation infrastructure. Author

N78-14498*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LANDSAT-D THEMATIC MAPPER SIMULATION USING AIRCRAFT MULTISPECTRAL SCANNER DATA
Jerry Clark and Nevin A. Bryant *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 339-351 (For availability see N78-14464 05-43)
(Contract NAS7-100)
Avail: NTIS HC A99/MF A01 CSCL 08B

A simulation of imagery from the upcoming LANDSAT-D thematic mapper was accomplished by using selected channels of 24-channels aircraft multispectral scanner data. The purpose was to simulate thematic mapper 30-meter resolution imagery and compare its spectral quality with the original aircraft MSS data and determine changes in thematic classification accuracy for the simulated imagery. The original resolution of approximately 7.5 meters IFOV and simulated resolution of 15, 30, and 60 meters were used to indicate the trend of spectral quality and classification accuracy. The study was based in a 6.5 square kilometer area of urban Los Angeles having a diversity of land use. Author

N78-14499*# Universidad Nacional Autonoma de Mexico, Villa Obregon. Interdisciplinario Lab.

A STUDY OF SUSPENDED SOLIDS IN THE REQUENA DAM BY REMOTE SENSING

P. Ruiz Azuara and L. Lemus Hidalgo *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 495-504 refs (For availability see N78-14464 05-43)
Avail: NTIS HC A99/MF A01 CSCL 08H

Remote sensing was applied to a preliminary study of suspended solids in the Requena Dam. Aerial and terrestrial photographs were analyzed by photointerpretation and microdensitometry. Field measurements and sampling were also made. A relationship between ground data for the concentration of suspended solids and the transmissibility of the aerial infrared film was suggested. Author

N78-14500*# California Univ., Berkeley. Dept. of Forestry and Resource Management.

USE OF MULTISPECTRAL DATA IN DESIGN OF FOREST SAMPLE SURVEYS

Stephen J. Titus and Lee C. Wensel *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 505-513 refs (For availability see N78-14464 05-43) (Contract NAS9-14552)
Avail: NTIS HC A99/MF A01 CSCL 02F

The use of multispectral data in design of forest sample surveys using a computer software package is described. The system allows evaluation of a number of alternative sampling systems and, with appropriate cost data, estimates the implementation cost for each. Author

N78-14501*# EROS Data Center, Sioux Falls, S. Dak.

MONITORING IRRIGATED LAND ACREAGE USING LANDSAT IMAGERY: AN APPLICATION EXAMPLE

William C. Draeger *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 515-524 ref (For availability see N78-14464 05-43)
Avail: NTIS HC A99/MF A01 CSCL 08B

A demonstration of the utility of LANDSAT imagery for quickly and cheaply estimating irrigated land area was conducted in the Klamath River basin of Oregon. LANDSAT color composite images, at 1:250,000 scale and acquired on two dates during the 1975 growing season, were interpreted. Irrigated lands were delineated manually, and the irrigated area was estimated, based on dot-grid sampling of the manually delineated lands. The image interpretation estimate of irrigated area was then adjusted by a comparison of interpretation results with ground data on 45 sample plots, each 2.6 square kilometers in size. Two interpreters independently estimated the irrigated area. Their adjusted estimates were 115,000 hectares and 108,000 hectares respectively, with corresponding 95 percent confidence intervals of + or - 7,880 hectares and + or - 14,000 hectares. Author

N78-14502*# Florida Univ., Gainesville. Dept. of Physics and Astronomy.

INFLUENCE OF GROUND LEVEL SO2 ON THE DIFFUSE TO DIRECT IRRADIANCE RATIO IN THE MIDDLE ULTRAVIOLET

K. F. Klenk and A. E. S. Green *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 525-533 refs (For availability see N78-14464 05-43) (Grant NSF ATM-75-21962)
Avail: NTIS HC A99/MF A01 CSCL 04A

The dependence of the ratio of the diffuse to direct irradiances at the ground were examined for a wavelength of 315.1 nm. A passive remote sensing method based on ratio measurements for obtaining the optical thickness of SO2 in the vertical column was proposed. If, in addition to the ratio measurements, the SO2 density at the ground is determining using an appropriate point-sampling technique then some inference on the vertical extent of SO2 can be drawn. An analytic representation is presented of the ratio for a wide range of SO2 and aerosol optical thicknesses and solar zenith angles which can be inverted algebraically to give the SO2 optical thickness in terms of the measured ratio, aerosol optical thickness and solar zenith angle. Author

N78-14503*# South Australian Inst. of Technology, Ingle Farm.

THE VECTOR CLASSIFIER

K. R. McCloy *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 535-543 refs (For availability see N78-14464 05-43)
Avail: NTIS HC A99/MF A01 CSCL 12A

A linear classifier is developed. The classifier algorithm derives, from the picture element (pixel) response values, the response values for a point (called footpoint) consisting of determined proportions of distinct and operator defined land surfaces. The algorithm decides whether the pixel contains the content of the defined surfaces by testing the footpoint to pixelpoint distance against an operator specified threshold value. The test can be either of statistical or geometric form. Those pixels which give a positive result to the test are subclassified according to the proportions of the distinct land surfaces. The practical characteristics of the classifier are discussed and the classification results achieved, in a number of test areas, are described. The artificial nature of the classifier assumptions relate to certain land surface conditions. Testing the suitability of the classifier for other conditions is discussed. Author

N78-14504*# Hosei Univ., Tokyo (Japan). Dept. of Civil Engineering.

MULTI-SEASONAL DATA ANALYSIS AND SOME EXTENSIONS FOR ENVIRONMENTAL MONITORING

Sotaro Tanaka (Remote Sensing Technol. Center of Japan, Tokyo), Yasushi Muranaka (Remote Sensing Technol. Center of Japan, Tokyo), Hiroshi Miyazawa (Tokyo Aero Surv. Co., Ltd., Tokyo), and Yuzo Suga *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 545-561 refs (For availability see N78-14464 05-43)
Avail: NTIS HC A99/MF A01 CSCL 04A

Multispectral data analysis was incorporated with multiseasonal data analysis based on a spectral radiance data-set. Concepts include comparing data types, exploring relationships between periodicity of LANDSAT and the seasonal sense of the Orientals, and derivation of a method to register the acquired data. Examples include a quality investigation of a paddy field by seasonal LANDSAT data, a progress check of the field in harvest season, and a detailed survey of the vegetational environment by summer and winter LANDSAT data. Author

N78-14505*# Environmental Research Inst. of Michigan, Ann Arbor.

DIGITAL EXPLOITATION OF SYNTHETIC APERTURE RADAR

H. L. Wagner and R. A. Shuchman *In its* Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 563-570 refs (For availability see N78-14464 05-43)
Avail: NTIS HC A99/MF A01 CSCL 17I

A digital processing and analysis scheme for use with digitized synthetic aperture radar data was developed. Using data from a four channel system, the imagery is preprocessed using specially designed software and then analyzed using preexisting facilities originally intended for use with MSS type data. Geometric and radiometric correction may be performed if desired, as well as classification analysis, Fast Fourier transform, filtering and level slice and display functions. The system provides low cost output in real time, permitting interactive imagery analysis. System information flow diagrams as well as sample output products are shown. Author

N78-14506*# Chiba Univ. (Japan). Inst. of Color Technology.

ON THE PHOTOGRAPHIC PROCESSING AND DIGITAL TEXTURE FOR REMOTE SENSING OF KUJUKURI COAST OF CHIBA IN JAPAN

Hidesaburo Genda, Hiroshi Okayama, Takashi Ishiyama, and Kaname Takeda (Natl. Inst. of Resources, Tokyo, Japan) *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 571-578 refs (For availability see N78-14464 05-43)
Avail: NTIS HC A99/MF A01 CSCL 14E

Remote sensing of various coastal phenomena on the Kujukuri Coast and Kashimanada Coast was done by the use of aircraft for the purpose of investigating the characteristics of shore reefs and floating sand, and the depth of the sea. A multispectral

camera and a video ITV camera were used as sensors. The first flight was over the Kashimanada and Kujukuri Coasts and the next flight was over the Katsuura Bay. The shape of shore reefs, the state of floating sand, the depth of the sea, etc., are represented by equidensitographs using texture. The interval of density slices is 0.05. Correlations between the textures represented by equidensitographs, digital graphs and analog display are estimated. Author

N78-14507*# GeoSpectra Corp., Ann Arbor, Mich.
LANDSAT DETECTION OF HYDROTHERMAL ALTERATION IN THE NOGAL CANYON CAULDRON, NEW MEXICO
Robert K. Vincent and George Rouse (Earth Sci., Inc., Golden, Colo.) *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 579-590 refs (For availability see N78-14464 05-43)
Avail: NTIS HC A99/MF A01 CSCL 08H

In 1974 a circular-shaped iron oxide anomaly was observed in an image of a LANDSAT frame centered near Truth or Consequences, New Mexico. Field examination of the anomaly has shown that it coincides with a zone of hydrothermal alteration on the northern edge of the Nogal Canyon Cauldron. The altered area contains clay minerals ranging in colors from white to vivid red, the latter presumably resulting from hematite staining. In situ gas measurements showed no evidence of active hydrogen sulfide seepage. Preliminary geochemical analyses of grab samples have detected no significant amounts of mineralization. Whereas this area does not at present appear to be economically important, it provides an example of how LANDSAT can be utilized in reconnaissance mapping for cauldrons, calderas, and other volcanic features which display hydrothermal alteration. Author

N78-14508*# California Univ., Santa Barbara. Geography Remote Sensing Unit.
AUTOMATED IMAGE PROCESSING OF LANDSAT 2 DIGITAL DATA FOR WATERSHED RUNOFF PREDICTION
Robert R. Sasso, John R. Jensen, and John E. Estes *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 591-599 refs (For availability see N78-14464 05-43)
(Grant NGR-05-025-001)
Avail: NTIS HC A99/MF A01 CSCL 08H

The U.S. Soil Conservation Service (SCS) model for watershed runoff prediction uses soil and land cover information as its major drivers. Kern County Water Agency is implementing the SCS model to predict runoff for 10,400 sq cm of mountainous watershed in Kern County, California. The Remote Sensing Unit, University of California, Santa Barbara, was commissioned by KCWA to conduct a 230 sq cm feasibility study in the Lake Isabella, California region to evaluate remote sensing methodologies which could be ultimately extrapolated to the entire 10,400 sq cm Kern County watershed. Digital results indicate that digital image processing of Landsat 2 data will provide usable land cover required by KCWA for input to the SCS runoff model. Author

N78-14509*# Bern Univ. (Switzerland). Inst. of Applied Physics.
MICROWAVE MULTISPECTRAL INVESTIGATIONS OF SNOW
E. Schanda and R. Hofer *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 601-607 refs (For availability see N78-14464 05-43)
Avail: NTIS HC A99/MF A01 CSCL 08L

A long term observational program on microwave emission and scatter behavior under controlled conditions, was started at a high altitude alpine test site. All stages of development of snow cover during the whole season are under investigation. The study was done to achieve required knowledge on microwave radiative properties of snow for optimization of the microwave payloads of air and spaceborne snow sensors and for the interpretation of large scale snow maps obtained by these sensors. Preliminary results of the first month obtained with radiometers at 4.9, 10.5, 21 and 36 GHz are presented. Author

N78-14510*# Tennessee Univ. Space Inst., Tullahoma. Remote Sensing Div.
APPLICATION OF LANDSAT DATA TO WETLAND STUDY AND LAND USE CLASSIFICATION IN WEST TENNESSEE
N. L. Jones and F. Shahrokhi *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 609-613 (For availability see N78-14464 05-43)
(Contract NAS8-31980)
Avail: NTIS HC A99/MF A01 CSCL 08C

The Obion-Forked Deer River Basin in northwest Tennessee is confronted with several acute land use problems which result in excessive erosion, sedimentation, pollution, and hydrologic runoff. LANDSAT data was applied to determine land use of selected watershed areas within the basin, with special emphasis on determining wetland boundaries. Densitometric analysis was performed to allow numerical classification of objects observed in the imagery on the basis of measurements of optical densities. Multispectral analysis of the LANDSAT imagery provided the capability of altering the color of the image presentation in order to enhance desired relationships. Manual mapping and classification techniques were performed in order to indicate a level of accuracy of the LANDSAT data as compared with high and low altitude photography for land use classification. Author

N78-14511*# Fairey Surveys Ltd., Maidenhead (England).
TESTING THE ACCURACY OF REMOTE SENSING LAND USE MAPS
J. L. VanGenderen, B. F. Lock (Salisbury College, Australia), and P. A. Vass *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 615-623 refs (For availability see N78-14464 05-43)
Avail: NTIS HC A99/MF A01 CSCL 08B

Some of the main aspects that need to be considered in a remote sensing sampling design are: (1) the frequency that any one land use type (on the ground) is erroneously attributed to another class by the interpreter; (2) the frequency that the wrong land use (as observed on the ground) is erroneously included in any one class by the remote sensing interpreter; (3) the proportion of all land (as determined in the field) that is mistakenly attributed by the interpreter; and (4) the determination of whether the mistakes are random (so that the overall proportions are approximately correct) or subject to a persistent bias. A sampling and statistical testing procedure is presented which allows an approximate answer to each of these aspects. The concept developed and described incorporates the probability of making incorrect interpretations at particular prescribed accuracy levels, for a certain number of errors, for a particular sample size. It is considered that this approach offers a meaningful explanation of the interpretation accuracy level of an entire remote sensing land use survey. Author

N78-14512*# National Oceanic and Atmospheric Administration, Suitland, Md.
PRESENT AND FUTURE OPERATIONAL NOAA SATELLITE OCEANOGRAPHIC PRODUCTS: AN INTRODUCTION
J. Keith Kalinowski, Theodore L. Signore, William G. Pichel, Charles C. Walton, Robert L. Brower, Stanley R. Brown, and Kenneth G. Bennekamper *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 625-633 refs (For availability see N78-14464 05-43)
Avail: NTIS HC A99/MF A01 CSCL 08C

A review of operational satellite-derived National Oceanic and Atmospheric Administration/National Environment Satellite Service oceanographic products is presented and some current applications of these products are noted. Recent improvements to procedures used in deriving sea surface temperature observations and fields are described. Changes to data reduction techniques and products which will be incorporated with the advent of TIROS-N are outlined and some potential future developments are mentioned. Author

N78-14513*# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
POLARIMETER MEASURES SEA STATE CHARACTERISTICS USING EMITTED INFRARED RADIATION
W. G. Egan and T. Hilgeman *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 635-644 refs (For availability see N78-14464 05-43)
Avail: NTIS HC A99/MF A01 CSCL 08C

An infrared polarimeter, capable of operating between 1 and 12 micrometers wavelength has been used to measure the

polarization of emitted radiation from the sea. The observed polarization at 10.6 micrometers from a smooth sea was found to be positive, indicating the dominance of reflected infrared sky radiation over the emitted. With the appearance of waves, the percent polarization increased, as expected, for a zenith angle well above the Brewster angle for water. This is qualitatively in accordance with a model presented to explain the behavior. Initial analyses indicate that the polarized components of the sea's emitted and reflected radiation are affected by type and direction of waves, angle of viewing, and foam. The effects of variations in these parameters require further delineation. The infrared polarimetric technique appears to be a novel new passive method for remote monitoring of waves. Author

N78-14514*# Canada Centre for Remote Sensing, Ottawa (Ontario).

SCATTEROMETER RESULTS FROM SHOREFAST AND FLOATING SEA ICE

J. Cihlar, L. Gray, S. Parashar, and R. Worsfold (Centre for Cold Ocean Resources Engineering, St. John's Canada) *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 645-657 refs (For availability see N78-14464 05-43)

Avail: NTIS HC A99/MF A01 CSCL 08L

Multipolarized scatterometer sea ice measurements at 13.3 GHz obtained during the winter and spring of 1975-76 from a number of flight lines off the east coast of Canada were analyzed. Radar scattering coefficients, sigma, were calculated for several regions of sea ice as interpreted from aerial photographs. The variation in sigma which incidence angle is presented for HH (Horizontal transmit - Horizontal receive) and HV (Horizontal transmit - Vertical receive) polarizations for the various ice regions. The depolarization ratio (sigma HH/sigma HV) as a function of incidence angle is also given. The sea ice regions studied included shorefast ice with varying degrees of snow cover and surface roughness and several varieties of floating sea ice with different thicknesses. Author

N78-14515*# Washington Univ., St. Louis, Mo. Center for Development Technology.

AN OPERATIONAL, MULTISTATE, EARTH OBSERVATION DATA MANAGEMENT SYSTEM

Lester F. Eastwood, Jr., Christopher T. Hill, Robert P. Morgan, John Kenneth Gohagan, Timothy R. Hays, Richard J. Ballard, Gregory G. Crnkovich, and Mark A. Schaeffer *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 659-670 refs (For availability see N78-14464 05-43)

Avail: NTIS HC A99/MF A01 CSCL 05A

State, local, and regional agencies involved in natural resources management were investigated as potential users of satellite remotely sensed data. This group's needs are assessed and alternative data management systems serving some of those needs are outlined. It is concluded that an operational earth observation data management system will be of most use to these user agencies if it provides a full range of information services -- from raw data acquisition to interpretation and dissemination of final information products. Author

N78-14516*# Alaska Univ., Fairbanks. Geophysical Inst.

REINDEER RANGE INVENTORY IN WESTERN ALASKA FROM COMPUTER-AIDED DIGITAL CLASSIFICATION OF LANDSAT DATA

T. H. George, W. J. Stringer, and J. N. Baldridge *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 671-682 refs (For availability see N78-14464 05-43)

Avail: NTIS HC A99/MF A01 CSCL 06C

An inventory of reindeer-range resources was conducted for the USDA Soil Conservation Service of 1.6 million hectares of wildlands in western Alaska using clustering techniques with digital Landsat data. Computer-aided digital analysis produced a provisional map of rangeland types which was used to design the field collection of vegetation and soil types data. This field data facilitated refinement of the inventory map and was used to describe the map units. The informational classes important to range resources were wet, moist and alpine tundra, tidal marsh, brush and open spruce forest. A significant feature of the study was the extraction of acreage figures by administrative boundaries within the study area. In addition to soil and vegetation association map products (at scales of 1:250,000 and 1:63,360) acreage values were tallied from the digital data for each of the four grazing permit areas established by the Bureau of Land Management. Author

N78-14517*# General Electric Co., Beltsville, Md.

REMOTE SENSING EXPLORATION FOR METALLIC MINERAL RESOURCES IN CENTRAL BAJA CALIFORNIA

Ralph N. Baker *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 683-691 refs (For availability see N78-14464 05-43)

Avail: NTIS HC A99/MF A01 CSCL 08G

Remote sensor data (primarily LANDSAT) was analyzed by photogeologic and computer-assisted enhancement techniques to evaluate the metallic mineral potential of Baja California. Overlays were prepared at 1:1,000,000 and 1:500,000 and included known geologic relationships and mineral occurrences, lineament, drainage and structural patterns, tonal anomalies, and enhancement results. Computer-assisted enhancement and classification of the test sites was performed using the IMAGE 100 system to identify subtle tonal anomalies thought related to mineralization using known sites as analysis guides. Mineral potential maps of Baja California were generated from these analyses and the ten highest priority targets visited. Preliminary assay results (atomic absorption analysis) for the samples recovered showed moderate to high geochemical anomalies for Copper (10 of 12 samples), Zinc (3 of 12 samples) and Lead (4 of 12 samples). Author

N78-14518*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

INVESTIGATION OF THEMATIC MAPPER SPATIAL, RADIOMETRIC, AND SPECTRAL RESOLUTION

James P. Morgenstern (ERIM, Ann Arbor), Richard F. Nalepka (ERIM, Ann Arbor), and Jon D. Erickson *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 693-701 refs (For availability see N78-14464 05-43) (Contract NAS9-14819)

Avail: NTIS HC A99/MF A01 CSCL 08B

Empirical evidence was provided for the definition of system specifications for the LANDSAT Follow-On Thematic Mapper (TM) and other future space Multispectral Sensor (MSS) systems. Specific sensor parameters addressed were spatial resolution, radiometric sensitivity, and to a lesser degree spectral bandwidths and locations. The study used selected available aircraft MSS data, characterized by narrow spectral bands, fine spatial resolution, and high signal-to-noise, as the basis for simulating spacecraft TM data of various spatial resolutions, radiometric sensitivities, and sets of spectral bands. The primary measure used in evaluating the effects of varying spatial and radiometric resolutions was agricultural crop mensuration accuracy using automatic (computer) information extraction techniques. Author

N78-14519*# Pan American Univ., Edinburg, Tex.

FURTHER TESTS OF THE SUITS REFLECTANCE MODEL

E. W. Lemaster and J. E. Chance *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 703-710 refs (For availability see N78-14464 05-43)

Avail: NTIS HC A99/MF A01 CSCL 20F

Experiments performed by stacking cotton leaves in the port of a spectroradiometer indicate that single leaf reflectance ceases to vary with more than two leaves in the visible region and eight leaves in the infrared region. Chance and LeMaster have shown that the Suits spectral reflectance model predicts an asymptotic dependence of crop reflectance on leaf area index (LAI) with crop reflectance static for leaf area indices in excess of two in the visible regions and six in the infrared regions of the spectrum. These results are experimentally verified in the field for Milam and Penjamo spring wheat, and a theoretical relationship is discussed that relates crop reflectance at 650 nm to crop canopy LAI. Experimental data are given that relate observer zenith angle to crop reflectance for wheat. The Suits reflectance model calculations for wheat fail to agree with this data. Author

N78-14520*# Michigan State Univ., East Lansing.
ESTIMATION OF OLD FIELD ECOSYSTEM BIOMASS USING LOW ALTITUDE IMAGERY
Salleh Mohd. Nor, Gene Safir, T. M. Burton, J. E. Hook, and G. Schultink *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 711-718 refs (For availability see N78-14464 05-43)
(Grant NGL-23-004-083)
Avail: NTIS HC A99/MF A01 CSCL 08H

Color-infrared photography was used to evaluate the biomass of experimental plots in an old-field ecosystem that was treated with different levels of waste water from a sewage treatment facility. Cibachrome prints at a scale of approximately 1:1,600 produced from 35 mm color infrared slides were used to analyze density patterns using prepared tonal density scales and multicell grids registered to ground panels shown on the photograph. Correlation analyses between tonal density and vegetation biomass obtained from ground samples and harvests were carried out. Correlations between mean tonal density and harvest biomass data gave consistently high coefficients ranging from 0.530 to 0.896 at the 0.001 significance level. Corresponding multiple regression analysis resulted in higher correlation coefficients. The results of this study indicate that aerial infrared photography can be used to estimate standing crop biomass on waste water irrigated old field ecosystems. Combined with minimal ground truth data, this technique could enable managers of wastewater irrigation projects to precisely time harvest of such systems for maximal removal of nutrients in harvested biomass. Author

N78-14521*# Humboldt State Coll., Arcata, Calif.
THE EFFECT OF SOIL WATER DEFICIT ON THE REFLECTANCE OF CONIFER SEEDLING CANOPIES
L. Fox *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 719-728 refs (For availability see N78-14464 05-43)
Avail: NTIS HC A99/MF A01 CSCL 02F

The effects of soil water deficit on spruce and pine seedling canopy reflectance, needle reflectance and transmittance, and canopy density were measured in a greenhouse with a diffuse source of radiant flux. A potential for early or pre-visual detection of plant water stress was not supported by these measurements made at visible, and reflected infrared wavelengths to 1950 nm. Needles were found to transmit approximately thirty percent of the radiant flux incident on them at 780 nm, ten percent at 700 nm, and were found to be opaque at 450, 550, 600 and 650 nm. Author

N78-14522*# Canada Centre for Remote Sensing, Ottawa (Ontario).
USE OF CLEAR LAKE AS STANDARD REFLECTORS FOR ATMOSPHERIC MEASUREMENT
F. J. Ahern, D. G. Goodenough, S. C. Jain, V. R. Rao, and G. Rochon (Universite Laval, Quebec, Canada) *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 731-755 refs (For availability see N78-14464 05-43)
Avail: NTIS HC A99/MF A01 CSCL 04A

A method is proposed for using clear lakes as dark backgrounds against which the atmospheric path radiance can be determined from satellite observations. If the path radiance can be determined to sufficient accuracy, the atmospheric extinction can be inferred with suitable radiative transfer models. An extensive program of observation was made to determine the magnitude and variability of the various contributors to the total radiance observed by a satellite. It is shown that the volume and surface reflectance contributions (in the absence of sunglint) are small, constant, and can be modeled accurately enough to make these an insignificant source of error. The sunglint radiance observed in this investigation may be a significant source of error. It is shown that atmospheric extinction can be inferred from the path radiance observation after systematic differences between the model and observations are removed. Author

N78-14523*# MacDonald, Dettwiler and Associates Ltd., Richmond (British Columbia).
A LOW-COST SYSTEM FOR RECEPTION AND PROCESSING OF LINE-SCAN DATA FROM LANDSAT AND OTHER SOURCES
D. S. Sloan, B. C. Isherwood, and J. S. MacDonald *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 757-773 (For availability see N78-14464 05-43)
Avail: NTIS HC A99/MF A01 CSCL 05B

A low-cost transportable earth resources ground station was built in Canada and installed to operational status at Shoe Cove, Newfoundland. The system concepts developed for this station provide timely availability of data in both photographic and digital form. The system was designed with several objectives in mind: (1) to provide a system which could receive, store and process line-scan image data from a wide variety of satellites, most especially the LANDSAT and NOAA (VHRR) series, as well as aircraft scanner data, and data from future remote sensing and meteorological satellites; (2) the system has been designed to be operated by a small staff and to produce black and white images and computer-compatible tapes (CCT's) of all relevant data; (3) the system is compact in its physical design so that it is possible to configure it as a self-contained ground station, housed in a 3 x 12 meter trailer; (4) the system is designed to process all data at real-time rates or better and is designed in a modular fashion so that it can be easily upgraded to do further processing of the data, and/or to handle new satellites and sensors. Author

N78-14524*# Department of Energy, Mines and Resources, Ottawa (Ontario).
THE USE OF LANDSAT IMAGERY TO LOCATE UNCHARTED COASTAL FEATURES ON THE LABRADOR COAST
E. A. Fleming and D. D. Lelievre (Canadian Hydrographic Service, Dartmouth, Nova Scotia) *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol 1 1977 p 775-781 (For availability see N78-14464 05-43)
Avail: NTIS HC A99/MF A01 CSCL 08B

A survey of several offshore islands, rocks and shoals on the Labrador Coast was performed, using LANDSAT imagery to assist in the location of uncharted hydrographic features. Several satellite coverages of the coast were studied prior to the survey, and suspected shoal points identified. Using map-derived control points and monocomparator measurements of the LANDSAT images, the positions of these points were determined by mathematical adjustment to an estimated position accuracy of 150 meters. As a result, on the survey, an uncharted island and eight uncharted drying rocks, which might easily have escaped detection from a survey ship, were verified and positioned. To check the accuracy of the coordinates derived from LANDSAT, three islands were positioned by standard ground survey methods. The positional differences, all less than 150 meters, are not plottable at the scale of the existing offshore charts. The LANDSAT positions were also used to control aerial photography of a shoal area for office compilation of a hydrographic chart. Author

N78-14525*# Stanford Univ., Calif. Remote Sensing Lab.
ALTERATION MAPPING AT GOLDFIELD, NEVADA, BY CLUSTER AND DISCRIMINANT ANALYSIS OF LANDSAT DIGITAL DATA
Gary Ballew *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 783-790 (For availability see N78-14464 05-43)
Avail: NTIS HC A99/MF A01 CSCL 08B

The ability of Landsat multispectral digital data to differentiate among 62 combinations of rock and alteration types at the Goldfield mining district of Western Nevada was investigated by using statistical techniques of cluster and discriminant analysis. Multivariate discriminant analysis was not effective in classifying each of the 62 groups, with classification results essentially the same whether data of four channels alone or combined with six ratios of channels were used. Bivariate plots of group means revealed a cluster of three groups including mill tailings, basalt and all other rock and alteration types. Automatic hierarchical clustering based on the fourth dimensional Mahalanobis distance between group means of 30 groups having five or more samples was performed. The results of the cluster analysis revealed hierarchies of mill tailings vs. natural materials, basalt vs. non-basalt, highly reflectant rocks vs. other rocks and exclusively unaltered rocks vs. predominantly altered rocks. The hierarchies were used to determine the order in which sets of multiple discriminant analyses were to be performed and the resulting discriminant functions were used to produce a map of geology

and alteration which has an overall accuracy of 70 percent for discriminating exclusively altered rocks from predominantly altered rocks. Author

N78-14526*# Minnesota Univ., St. Paul.
QUATERNARY GEOLOGIC MAP OF MINNESOTA
J. E. Goebel *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 791-794 (For availability see N78-14464 05-43)
Avail: NTIS HC A99/MF A01 CSCL 08G

The Quaternary Geologic Map of Minnesota is a compilation based both on the unique characteristics of satellite imagery and on the results of previous field investigations, both published and unpublished. The use of satellite imagery has made possible the timely and economical construction of this map. LANDSAT imagery interpretation proved more useful than expected. Most of the geologic units could be identified by extrapolating from specific sites where the geology had been investigated into areas where little was known. The excellent geographic registry coupled with the multi-spectral record of these images served to identify places where the geologic materials responded to their ecological environment and where the ecology responded to the geologic materials. Units were well located on the map at the scale selected for the study. Contacts between till units could be placed with reasonable accuracy. The reference points that were used to project delineations between units (rivers, lakes, hills, roads and other features), which had not been accurately located on early maps, could be accurately located with the help of the imagery. The tonal and color contrasts, the patterns reflecting geologic change and the resolution of the images permitted focusing attention on features which could be represented at the final scale of the map without distraction by other interesting but site-specific details. Author

N78-14527*# California Univ., Berkeley. Space Sciences Lab.
REMOTE SENSING-AIDED SYSTEMS FOR SNOW QUALIFICATION, EVAPOTRANSPIRATION ESTIMATION, AND THEIR APPLICATION IN HYDROLOGIC MODELS
Siamak Korram *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 795-806 refs (For availability see N78-14464 05-43)
Avail: NTIS HC A99/MF A01 CSCL 08L

The design of general remote sensing-aided methodologies was studied to provide the estimates of several important inputs to water yield forecast models. These input parameters are snow area extent, snow water content, and evapotranspiration. The study area is Feather River Watershed (780,000 hectares), Northern California. The general approach involved a stepwise sequence of identification of the required information, sample design, measurement/estimation, and evaluation of results. All the relevent and available information types needed in the estimation process are being defined. These include Landsat, meteorological satellite, and aircraft imagery, topographic and geologic data, ground truth data, and climatic data from ground stations. A cost-effective multistage sampling approach was employed in quantification of all the required parameters. The physical and statistical models for both snow quantification and evapotranspiration estimation was developed. These models use the information obtained by aerial and ground data through appropriate statistical sampling design. Author

N78-14528*# Michigan State Univ., East Lansing.
APPLICATION OF AERIAL PHOTOGRAPHY TO WATER-RELATED PROGRAMS IN MICHIGAN
W. R. Enslin, R. Hill-Rowley, and S. E. Tilmann *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 807-816 (For availability see N78-14464 05-43) (Grant NGL-23-004-083)
Avail: NTIS HC A99/MF A01 CSCL 08H

Aerial photography and information system technology were used to generate information required for the effective operation of three water-related programs in Michigan. Potential mosquito breeding sites were identified from specially acquired low altitude 70 mm color photography for the city of Lansing; the inventory identified 35% more surface water areas than indicated on existing field maps. A comprehensive inventory of surface water sources and potential access sites was prepared to assist fire departments in Antrim County with fire truck water-recharge operations. Remotely-sensed land cover/use data for Windsor Township, Eaton County, were integrated with other resource data into a computer-based information system for regional water quality studies. Eleven thematic maps focusing on landscape features affecting non-point water pollution and waste disposal were generated from analyses of a four-hectare grid-based data file containing land cover/use, soils, topographic and geologic (well-log) data. Author

N78-14529*# Environmental Research Inst. of Michigan, Ann Arbor. Center for Remote Sensing Information and Analysis.
PROCEEDINGS OF THE ELEVENTH INTERNATIONAL SYMPOSIUM ON REMOTE SENSING OF ENVIRONMENT, VOLUME 2
1977 826 p refs Symp. held at Ann Arbor, Mich., 25-29 Apr. 1977 Sponsored in part by NASA, FHA, NOAA, Geolog. Survey, Dept. of Agr., Army Res. Center, TVA, Coast Guard, ERDA and EPA Original contains color illustrations
(NASA-CR-155362) Avail: NTIS HC A99/MF A01 CSCL 05B

Application and processing of remotely sensed data are discussed. Areas of application include: pollution monitoring, water quality, land use, marine resources, ocean surface properties, and agriculture. Image processing and scene analysis are described along with automated photointerpretation and classification techniques. Data from infrared and multispectral band scanners onboard LANDSAT satellites are emphasized. For individual titles, see N78-14530 through N78-14609.

N78-14530*# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
REMOTE SENSING OF AQUATIC PLANTS
K. S. Long and L. E. Link, Jr. *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 817-836 refs (For availability see N78-14529 05-43)
Avail: NTIS HC A99/MF A01 CSCL 02D

Various sensors were tested in terms of their ability to detect and discriminate among noxious aquatic macrophytes. A survey of researchers currently studying the problem and a brief summary of their work is included. Results indicated that the sensor types best suited to assessment of the aquatic environment are color, color infrared, and black-and-white infrared film, which furnish consistently high contrasts between aquatic plants and their surroundings. Author

N78-14531*# Ruhr Planning Authority, Essen (West Germany).
THE APPLICATION OF IR- AND MSS-DATA IN THE RUHR DISTRICT, GERMANY
P. Stock *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 837-847 refs (For availability see N78-14529 05-43)
Avail: NTIS HC A99/MF A01 CSCL 08B

The methods used by Ruhr Planning Authority to interpret IR pictures are described along with production of maps indicating the thermal distribution in the conurbation. Topics studied with the IR data include thermal loading of the Rhine and climatology of the urban and surrounding country areas. Author

N78-14532*# National Oceanic and Atmospheric Administration, Washington, D. C.
POTENTIAL APPLICATIONS OF DIGITAL, VISIBLE, AND INFRARED DATA FROM GEOSTATIONARY ENVIRONMENTAL SATELLITES
D. B. Miller, M. P. Waters, III, J. D. Tarpley, R. N. Green, and D. C. Dismachek *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 849-858 refs (For availability see N78-14529 05-43)
Avail: NTIS HC A99/MF A01 CSCL 05B

An hourly, digital data base from the Visible/Infrared Spin-Scan Radiometer (VISSR) instrument on the GOES-1 and SMS-2 geostationary satellites is described. Several examples of developmental applications of these quantitative digital data are presented. These include a review of recent attempts to develop products that are of use to meteorologists who provide services to aviation, agriculture, forestry, hydrology, oceanography, and climatology. The sample products include high resolution thermal gradients of land and ocean surfaces, thermal change

analyses, fruit frost/freeze application, cloud-top altitude analysis, analysis of hurricane characteristics, and analyses of solar insolation. Author

N78-14533*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
STUDY OF THE BRAZIL AND FALKLAND CURRENTS USING THEIR IMAGES OF NIMBUS 5 AND OCEANOGRAPHIC DATA IN 1972 - 1973
Y. C. Tseng, H. M. V. Inostroza, and R. Kumar *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 859-871 refs (For availability see N78-14529 05-43)
Avail: NTIS HC A99/MF A01 CSCL 05B

The Western Edge of the Sub-tropical Convergance of the South-western Atlantic Ocean, called the Front, which is a thermal discontinuity between the Brazil and Falkland Currents, was studied utilizing the Temperature Humidity Infrared Radiometer (THIR) of Nimbus V in the 10.5 to 12.5 micrometers channel and historical oceanographic data. Some important results obtained are: the oceanographic Front could be detected from Nimbus THIR data; oceanographic charts showed that the transition zone where the Brazil and the Falkland Currents meet was the Front detected from satellite data; ocean current speeds calculated with THIR data were of the same order of magnitude as those calculated oceanographically; fisheries statistics for Pargo Roseo showed that the maximum catches were in September of 1973, in the period when the Front was observed most distinctly and clearly. The results showed the great potentiality of satellite data to study surface thermal structures, surface currents and oceanic fisheries. Author

N78-14534*# Lund Univ. (Sweden). Dept. of Physical Geography.
LANDSAT DIGITAL DATA FOR WATER POLLUTION AND WATER QUALITY STUDIES IN SOUTHERN SCANDINAVIA
Ulf Hellden and Ingvar Akersten (Natl. Defence Res. Inst., Stockholm, Sweden) *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 875-884 refs (For availability see N78-14529 05-43)
Avail: NTIS HC A99/MF A01 CSCL 08H

Spectral diagrams, illustrating the spectral characteristics of different water types, were constructed by means of simple statistical analysis of the various reflectance properties of water areas in Southern Scandinavia as registered by LANDSAT-1. There were indications that water whose spectral reproduction is dominated by chlorophyllous matter (phytoplankton) can be distinguished from water dominated by nonchlorophyllous matter. Differences between lakes, as well as the patchiness of individual lakes, concerning secchi disc transparency could be visualized after classification and reproduction in black and white and in color by means of line printer, calcomp plotter (CRT), and ink jet plotter respectively. Author

N78-14535*# Metrics, Inc., Atlanta, Ga.
INDICATORS OF INTERNATIONAL REMOTE SENSING ACTIVITIES
G. William Spann *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 885-891 (For availability see N78-14529 05-43)
Avail: NTIS HC A99/MF A01 CSCL 05B

The extent of worldwide remote sensing activities, including the use of satellite and high/medium altitude aircraft data was studied. Data were obtained from numerous individuals and organizations with international remote sensing responsibilities. Indicators were selected to evaluate the nature and scope of remote sensing activities in each country. These indicators ranged from attendance at remote sensing workshops and training courses to the establishment of earth resources satellite ground stations and plans for the launch of earth resources satellites. Results indicate that this technology constitutes a rapidly increasing component of environmental, land use, and natural resources investigations in many countries, and most of these countries rely on the LANDSAT satellites for a major portion of their data. Author

N78-14536*# Consiglio Nazionale delle Richerche, Venice (Italy). Laboratorio per lo Studio della Dinamica delle Grandi Masse.
QUANTITATIVE EVALUATION OF WATER BODIES DYNAMIC BY MEANS OF THERMAL INFRARED AND MULTISPECTRAL SURVEYS ON THE VENETIAN LAGOON
L. Alberotanza and G. M. Lechi (CNR, Milano, Italy) *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 893-902 (For availability see N78-14529 05-43)
Avail: NTIS HC A99/MF A01 CSCL 08H

Surveys employing a two channel Daedalus infrared scanner and multispectral photography were performed. The spring waning tide, the velocity of the water mass, and the types of suspended matter were among the topics studied. Temperature, salinity, sediment transport, and ebb stream velocity were recorded. The bottom topography was correlated with the dynamic characteristics of the sea surface. Author

N78-14537*# Societe Europeene de Propulsion, Vernon (France).
VIZIR: THE SEP HIGH RESOLUTION LASER BEAM RECORDER
M. L. Salter and M. G. Maincent *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 903-907 (For availability see N78-14529 05-43)
Avail: NTIS HC A99/MF A01 CSCL 20E

A means for high density archiving of meteorological data on a photographic film is described. The data are stored on-line under a form accessible to interpretation. The VIZIR thus forms the final link of the receiving system of a ground station. Author

N78-14538*# California Univ., Berkeley. Space Sciences Lab.
TWO PHASE SAMPLING FOR WHEAT ACREAGE ESTIMATION
Randall W. Thomas and Claire M. Hay *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 909-918 refs (For availability see N78-14529 05-43) (Contract NAS9-14565)
Avail: NTIS HC A99/MF A01 CSCL 02C

A two phase LANDSAT-based sample allocation and wheat proportion estimation method was developed. This technique employs manual, LANDSAT full frame-based wheat or cultivated land proportion estimates from a large number of segments comprising a first sample phase to optimally allocate a smaller phase two sample of computer or manually processed segments. Application to the Kansas Southwest CRD for 1974 produced a wheat acreage estimate for that CRD within 2.42 percent of the USDA SRS-based estimate using a lower CRD inventory budget than for a simulated reference LACIE system. Factor of 2 or greater cost or precision improvements relative to the reference system were obtained. Author

N78-14539*# Arkansas Univ., Fayetteville. Dept. of Mathematics.
CLASSIFICATION OF LANDSAT AGRICULTURAL DATA BASED UPON COLOR TRENDS
J. D. Tubbs *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 919-923 refs (For availability see N78-14529 05-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

An automated classification procedure is described. The decision rules were developed for classifying an unknown observation by matching its color trend with that of expected trends for known crops. The results of this procedure were found to be encouraging when compared with the usual supervised classification procedures. Author

N78-14540*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE USE OF LANDSAT DIGITAL DATA TO DETECT AND MONITOR VEGETATION WATER DEFICIENCIES
D. R. Thompson and O. A. Wehmanen (Lockheed Electron. Co., Inc., Houston, Tex.) *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 925-931 refs (For availability see N78-14529 05-43)
(Contract NAS9-15200)
Avail: NTIS HC A99/MF A01 CSCL 02C

A technique devised using a vector transformation of LANDSAT digital data to indicate when vegetation is undergoing

moisture stress is described. A relation established between the remote sensing-based criterion (the Green Index Number) and a ground-based criterion (Crop Moisture Index) is discussed.
Author

N78-14541*# Michigan Univ., Ann Arbor. School of Natural Resources.
PRE-VISUAL DETECTION OF STRESS IN PINE FORESTS
Charles E. Olson, Jr. *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 933-944 refs (For availability see N78-14529 05-43)
Avail: NTIS HC A99/MF A01 CSCL 02F

Pre-visual, or early, detection of forest stress with particular reference to detection of attacks by pine bark beetles is discussed. Preliminary efforts to obtain early detection of attacks by pine bark beetles, using MSS data from the ERIM M-7 scanner, were not sufficiently successful to demonstrate an operational capability, but indicate that joint processing of the 0.71 to 0.73, 2.00 to 2.60, and 9.3 to 11.7 micrometer bands holds some promise. Ratio processing of transformed data from the 0.45 to 0.52, 1.55 to 2.60, and 4.5 to 5.5 or 9.3 to 11.7 micrometer regions appears even more promising. Author

N78-14542*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
VIEW ANGLE EFFECT IN LANDSAT IMAGERY
Toyohisa Kaneko (IBM Corp., Houston, Tex.) and John L. Engvall *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 945-951 refs (For availability see N78-14529 05-43)
(Contract NAS9-14350)
Avail: NTIS HC A99/MF A01 CSCL 20F

The view angle effect in LANDSAT 2 imagery was investigated. The LANDSAT multispectral scanner scans over a range of view angles of -5.78 to 5.78 degrees. The view angle effect, which is caused by differing view angles, could be studied by comparing data collected at different view angles over a fixed location at a fixed time. Since such LANDSAT data is not available, consecutive day acquisition data were used as a substitute: they were collected over the same geographical location, acquired 24 hours apart, with a view angle change of 7 to 8 degrees at a latitude of 35 to 45 degrees. It is shown that there is approximately a 5% reduction in the average sensor response on the second-day acquisitions as compared with the first-day acquisitions, and that the view angle effect differs field to field and crop to crop. On false infrared color pictures the view angle effect causes changes primarily in brightness and to a lesser degree in color (hue and saturation). An implication is that caution must be taken when images with different view angles are combined for classification and a signature extension technique needs to take the view angle effect into account. Author

N78-14543*# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany).
REMOTE INFRARED SPECTROSCOPY OF THE EARTH
C. R. Steinmann *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 957-967 refs (For availability see N78-14529 05-43)
Avail: NTIS HC A99/MF A01 CSCL 08G

The infrared reflexion-spectra of minerals and rocks are used for remote sensing of targets. The reflexion-spectra of silicate rocks vary quite significantly from mineral to mineral in the wave length region from 8 to 12 micrometers. The rock forming minerals like quartz, feldspar, mica and the clay minerals show very different spectral shapes and positions of their maximum of the spectral reflexion. The presence of a good atmospherical window in that spectral region makes the method of differential-reflexion measurement feasible, for remote sensing application. A tunable CO2-laser was used as transmitter for infrared radiation. Laboratory tests showed the feasibility of the method under different simulated environmental conditions. Because of the very narrow bandwidth of the laser-emission lines, reflexion-spectra with extremely high spectral resolution were obtained. Author

N78-14544*# Indian Space Research Organization, Admedabad. Remote Sensing Area.
IMAGE ANALYSIS TECHNIQUES WITH SPECIAL REFERENCE TO ANALYSIS AND INTERPRETATION OF GEOLOGICAL FEATURES FROM LANDSAT IMAGERY
D. S. Kamat, K. L. Majumder, S. D. Naik, and V. L. Swaminathan *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 969-978 refs (For availability see N78-14529 05-43)
Avail: NTIS HC A99/MF A01 CSCL 08G

The principal component analysis enhances the contrast existing between the different cover types present in an imagery. A procedure is presented with regards to the determination of the principal components. The method is tested for a portion of the LANDSAT imagery pertaining to Anantapur region. Another technique, using the concept of non-linear contrast stretching is defined and developed and carried out on the same imagery. The results are presented as photographs. An interpretation of the geology of the region is derived from these photographs.
Author

N78-14545*# Colorado State Univ., Fort Collins. Dept. of Earth Resources.
MULTIDATE MAPPING OF MOSQUITO HABITAT
Thomas L. Woodzick and Eugene L. Maxwell *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 979-989 refs Sponsored by PHS (For availability see N78-14529 05-43)
Avail: NTIS HC A99/MF A01 CSCL 06C

LANDSAT data from three overpasses formed the data base for a multidate classification of 15 ground cover categories in the margins of Lewis and Clark Lake, a fresh water impoundment between South Dakota and Nebraska. When scaled to match topographic maps of the area, the ground cover classification maps were used as a general indicator of potential mosquito-breeding habitat by distinguishing productive wetlands areas from nonproductive nonwetlands areas. The 12 channel multidate classification was found to have an accuracy 23% higher than the average of the three single date 4 channel classifications.
Author

N78-14546*# Old Dominion Univ., Norfolk, Va. Remote Sensing Lab.
NECESSITY TO ADAPT LAND USE AND LAND COVER CLASSIFICATION SYSTEMS TO READILY ACCEPT RADAR DATA
Ben Drake *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 993-1000 refs (For availability see N78-14529 05-43)
Avail: NTIS HC A99/MF A01 CSCL 08B

A hierarchial, four level, standardized system for classifying land use/land cover primarily from remote-sensor data (USGS system) is described. The USGS system was developed for nonmicrowave imaging sensors such as camera systems and line scanners. The USGS system is not compatible with the land use/land cover classifications at different levels that can be made from radar imagery, and particularly from synthetic-aperture radar (SAR) imagery. The use of radar imagery for classifying land use/land cover at different levels is discussed, and a possible revision of the USGS system to more readily accept land use/land cover classifications from radar imagery is proposed. Author

N78-14547*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
APPLICATION OF AIRBORNE INFRARED TECHNOLOGY TO MONITOR BUILDING HEAT LOSS
Fred J. Tanis and Robert E. Sampson *In its* Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1001-1003 refs (For availability see N78-14529 05-43)
Avail: NTIS HC A99/MF A01 CSCL 20D

The application of airborne infrared technology to the requirements for energy conservation in buildings was studied. Quantitative airborne data of the City of Ypsilanti, Michigan, were collected and processed to identify roof temperatures. A thermal scanner was flown at an altitude of 1,200 feet with two thermal bands 8.2-9.3 micrometers and 10.4-12.5 micrometers recorded by an analog system. Calibration was achieved by standard hot and cold plates. Using a thermal model to interpret ceiling insulation status, environmental factors were found to influence the relation between roof temperature and insulation. These include interior and sky temperatures, roofing materials,

and the pitch and orientation of the roof. A follow-up mail survey established the ability to identify insulated and uninsulated houses from the airborne infrared data. Author

N78-14548*# National Oceanic and Atmospheric Administration, Washington, D. C.
PROCESSING OF SATELLITE IMAGERY AT THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE
M. Crowe *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1015-1020 refs (For availability see N78-14529 05-43)
Avail: NTIS HC A99/MF A01 CSCL 05B

The National Environmental Satellite Service (NESS) image product processing system is described. Other topics discussed include: (1) image processing of polar-orbiter satellite data; (2) image processing of geostationary satellite data; and (3) quality assurance and product monitoring. Author

N78-14549*# Universite des Sciences et Techniques de Lille (France). Laboratoire d'Optique Atmospherique.
REMOTE SENSING OF OCEAN COLOR AND DETECTION OF CHLOROPHYLL CONTENT
P. Y. Deschamps, P. Lecompte, and M. Viollier *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1021-1033 refs (For availability see N78-14529 05-43)
Avail: NTIS HC A99/MF A01 CSCL 08J

The chlorophyll enrichment of the water in an equatorial upwelling was surveyed and described with the aid of a radiometer specially designed for the airborne measurement of ocean color. A relation is proposed between airborne measurement of difference of albedos at two wavelengths in the blue and green, and the concentration of chlorophyll in the ocean. Author

N78-14550*# Ludwig-Maximilians-Universitat, Munich (West Germany). Institut fur Geographie.
TEXTURAL ANALYSIS BY STATISTICAL PARAMETERS AND ITS APPLICATION TO THE MAPPING OF FLOW-STRUCTURES IN WETLANDS
U. Wieczorek *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1035-1043 refs (For availability see N78-14529 05-43)
Avail: NTIS HC A99/MF A01 CSCL 08B

From 1974 to 1977, the application of remote sensing methods in coastal areas and tidal bays and estuaries was investigated on the German coast of the North Sea. Aerial photographs were taken using different films; (1) color, (2) color infrared, and (3) black and white films. Scanner recordings were taken by an 11 channel scanner. Ground truth measurements of radiation and measurements of meteorological elements were carried out. For mapping the morphology in mudflat areas a digital texture analysis was developed, by which measurement of the change of image structures cased by distributing factors, such as changing illumination, is possible. Author

N78-14551*# Bendix Corp., Ann Arbor, Mich. Aerospace Systems Div.
PRODUCTION OF A WATER QUALITY MAP OF SAGINAW BAY BY COMPUTER PROCESSING OF LANDSAT-2 DATA
John B. Mckeon, Robert H. Rogers, and V. Elliott Smith (Cranbrook Inst. of Sci., Bloomfield Hills, Mich.) *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1045-1054 refs Sponsored by EPA (For availability see N78-14529 05-43)
Avail: NTIS HC A99/MF A01 CSCL 08H

Surface truth and LANDSAT measurements collected July 31, 1975, for Saginaw Bay were used to demonstrate a technique for producing a color coded water quality map. On this map, color was used as a code to quantify five discrete ranges in the following water quality parameters: (1) temperature, (2) Secchi depth, (3) chloride, (4) conductivity, (5) total Kjeldahl nitrogen, (6) total phosphorous, (7)chlorophyll a, (8) total solids and (9) suspended solids. The LANDSAT and water quality relationship was established through the use of a set of linear regression equations where the water quality parameters are the dependent variables and LANDSAT measurements are the independent variables. Although the procedure is scene and surface truth dependent, it provides both a basis for extrapolating water quality parameters from point samples to unsampled areas and a synoptic view of water mass boundaries over the 3000 sq. km bay area made from one day's ship data that is superior, in many ways, to the traditional machine contoured maps made from three day's ship data. Author

N78-14552*# Agency for International Development, Washington, D.C.
REMOTE SENSING UTILIZATION OF DEVELOPING COUNTRIES: AN APPROPRIATE TECHNOLOGY c43
Merrill W. Conitz and Donald S. Lowe *In* ERIM Proc. of the 11th Intern. Symp. Remote Sensing of Environment, Vol. 2 1977 p 1055-1064 refs (For availability see N78-14529 05-42)
Avail: NTIS HC A99/MF A01 CSCL 05B

The activities of the Agency for international development were discussed. Regional and national training centers were established to create an understanding of the role and impact of remote sensing on the developing process. Workshops, training seminars, and demonstration projects were conducted. Research on application was carried out and financial and technical assistance to build or strengthen a country's capability were granted. Author

N78-14553*# Battelle Columbus Labs., Ohio.
A SURVEY OF USERS OF EARTH RESOURCES REMOTE SENSING DATA
G. E. Wukelic, J. G. Stephan, H. E. Smail, and T. F. Ebbert *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1067-1076 refs Sponsored by NASA (For availability see N78-14529 05-43)
Avail: NTIS HC A99/MF A01 CSCL 05B

The results of a NASA supported Battelle survey to obtain user views on the nature and value of LANDSAT data use, on current LANDSAT capabilities, and on ways to improve data use were summarized. Questionnaire and interview responses from over 1000 private and public sector users were analyzed and discussed. Author

N78-14554*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
EVALUATION OF SPECTRAL CHANNELS AND WAVELENGTH REGIONS FOR SEPARABILITY OF AGRICULTURAL COVER TYPES
R. Kumar *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1081-1090 refs (For availability see N78-14529 05-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The spectral channels were evaluated as well as wavelength regions; visible, near infrared, middle infrared and thermal infrared were evaluated with respect to their estimated probability of correct classification (P sub c) in discriminating agricultural cover types. Multispectral scanner data in twelve spectral channels in the wavelength range of 0.4 to 11.7 micrometers acquired in the middle of July for three flightlines were analyzed by applying automatic pattern recognition techniques. The same analysis was performed for the data acquired in the middle of August, over the same three flightlines, to investigate the effect of time on the results. The effect of deletion of each spectral channel as well as each wavelength region on P sub c was given. Values of P sub c for all possible combinations of wavelength regions in the subsets of one to twelve spectral channels were also given. The overall values of P sub c were found to be greater for the data of the middle of August than the data of the middle of July. Author

N78-14555*# INTERA Environmental Consultants Ltd., Houston, Tex.
THERMAL IMAGERY FOR CENSUS OF UNGULATES
M. C. Wride and K. Baker (Parks Canada, Western Region) *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1091-1099 refs (For availability see N78-14529 05-43)
Avail: NTIS HC A99/MF A01 CSCL 06C

A Daedalus thermal linescanner mounted in a light single engine aircraft was used to image the entire 270 square kilometers within the fenced perimeter of EIK Island Park, Alberta, Canada. The data were collected during winter, 1976 in morning and midday (overcast conditions) processed and analyzed to obtain

a number for total ungulates. Five different ungulate species were present during the survey. Ungulates were easily observed during the analysis of linescanner imagery and the total number of ungulates was established at 2175 compared to figures of 1010 and 1231 for visual method aerial survey results of the same area that year. It was concluded that the scanner was much more accurate and precise for census of ungulates than visual techniques. Author

N78-14556*# INTERA Environmental Consultants Ltd., Calgary (Alberta).

REMOTE SENSING IN OPERATIONAL RANGE MANAGEMENT PROGRAMS IN WESTERN CANADA

M. D. Thompson *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1101-1110 refs (For availability see N78-14529 05-43)

Avail: NTIS HC A99/MF A01 CSCL 05A

A pilot program carried out in Western Canada to test remote sensing under semi-operational conditions and display its applicability to operational range management programs was described. Four agencies were involved in the program, two in Alberta and two in Manitoba. Each had different objectives and needs for remote sensing within its range management programs, and each was generally unfamiliar with remote sensing techniques and their applications. Personnel with experience and expertise in the remote sensing and range management fields worked with the agency personnel through every phase of the pilot program. Results indicate that these agencies have found remote sensing to be a cost effective tool and will begin to utilize remote sensing in their operational work during ensuing seasons. Author

N78-14557*# Canadian Forestry Service, Ottawa (Ontario). Forest Fire Research Institute.

AN APPLICATION OF LANDSAT DIGITAL TECHNOLOGY TO FOREST FIRE FUEL TYPE MAPPING

P. H. Kourtz *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1111-1115 (For availability see N78-14529 05-43)

Avail: NTIS HC A99/MF A01 CSCL 02F

The role of digital classifications suitable as fuel maps was examined. A Taylor enhancement was produced for an 8 million hectare fire control region showing water, muskeg, coniferous, deciduous and mixed stands, clearcut logging, burned areas, regeneration areas, nonforested areas and large forest roads. Use of the map by fire control personnel demonstrated its usefulness for initial attack decision making. Author

N78-14558*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.

LANDSAT IMAGE INTERPRETATION AIDS

R. A. Abotteen and H. Malek *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1117-1121 refs (For availability see N78-14529 05-43) (Contract NAS9-15200)

Avail: NTIS HC A99/MF A01 CSCL 05B

In the Large Area Crop Inventory Experiment, image interpretation aids were produced to assist in selecting and/or identifying representative samples of signatures in a given LANDSAT scene. The three methods employed are based on clustering techniques, information extraction, and aggregation of like spectral information on a two dimensional spectral plot. Author

N78-14559*# Environmental Research Inst. of Michigan, Ann Arbor.

DIGITAL PROCESSING SYSTEM FOR DEVELOPING COUNTRIES

Chris Nanayakkara and Harvey Wagner *In its* Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 5 1977 p 1123-1126 refs (For availability see N78-14529 05-43)

Avail: NTIS HC A99/MF A01 CSCL 05B

An effort was undertaken to perform simple digital processing tasks using pre-existing general purpose digital computers. An experimental software package, LIGMALS, was obtained and modified for this purpose. The resulting software permits basic processing tasks to be performed including level slicing, gray mapping and ratio processing. The experience gained in this project indicates a possible direction which may be used by other developing countries to obtain digital processing capabilities. Author

N78-14560*# Environmental Research Inst. of Michigan, Ann Arbor. Information Systems and Analysis Dept.

REMOTE SENSING AND GEOGRAPHICALLY BASED INFORMATION SYSTEMS

Richard C. Cicone *In its* Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1127-1136 refs (For availability see N78-14529 05-43) (Contract NAS9-14988)

Avail: NTIS HC A99/MF A01 CSCL 08F

The incorporation of remotely sensed digital data in a computer based information system is seen to be equivalent to the incorporation of any other spatially oriented layer of data. The growing interest in such systems indicates a need to develop a generalized geographically oriented data base management system that could be made commercially available for a wide range of applications. Some concepts that distinguish geographic information systems were reviewed, and a simple model which can serve as a conceptual framework for the design of a generalized geographic information system was examined. Author

N78-14561*# Environmental Research Inst. of Michigan, Ann Arbor.

INTEGRATION OF REMOTE SENSING AND SURFACE GEOPHYSICS IN THE DETECTION OF FAULTS

P. L. Jackson, R. A. Shuchman, H. Wagner, and F. Ruskey (Bureau of Mines, Denver) *In its* Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1137-1146 (For availability see N78-14529 05-43)

Avail: NTIS HC A99/MF A01 CSCL 08G

Remote sensing was included in a comprehensive investigation of the use of geophysical techniques to aid in underground mine placement. The primary objective was to detect faults and slumping, features which, due to structural weakness and excess water, cause construction difficulties and safety hazards in mine construction. Preliminary geologic reconnaissance was performed on a potential site for an underground oil shale mine in the Piceance Creek Basin of Colorado. LANDSAT data, black and white aerial photography and 3 cm radar imagery were obtained. LANDSAT data were primarily used in optical imagery and digital tape forms, both of which were analyzed and enhanced by computer techniques. The aerial photography and radar data offered supplemental information. Surface linears in the test area were located and mapped principally from LANDSAT data. A specific, relatively wide, linear pointed directly toward the test site, but did not extend into it. Density slicing, ratioing, and edge enhancement of the LANDSAT data all indicated the existence of this linear. Radar imagery marginally confirmed the linear, while aerial photography did not confirm it. Author

N78-14562*# Geological Survey, Denver, Colo.

EVALUATION OF ALGORITHMS FOR GEOLOGICAL THERMAL-INERTIA MAPPING

S. H. Miller and Kenneth Watson *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1147-1160 refs (For availability see N78-14529 05-43)

Avail: NTIS HC A99/MF A01 CSCL 08B

The errors incurred in producing a thermal inertia map are of three general types: measurement, analysis, and model simplification. To emphasize the geophysical relevance of these errors, they were expressed in terms of uncertainty in thermal inertia and compared with the thermal inertia values of geologic materials. Thus the applications and practical limitations of the technique were illustrated. All errors were calculated using the parameter values appropriate to a site at the Raft River, Id. Although these error values serve to illustrate the magnitudes that can be expected from the three general types of errors, extrapolation to other sites should be done using parameter values particular to the area. Three surface temperature algorithms were evaluated: linear Fourier series, finite difference, and Laplace transform. In terms of resulting errors in thermal inertia, the Laplace transform method is the most accurate (260 TIU), the forward finite difference method is intermediate (300 TIU), and the linear Fourier series method the least accurate (460 TIU). Author

N78-14563*# Geological Survey, Helena, Mont.
USE OF THERMAL-INFRARED IMAGERY IN GROUND-WATER INVESTIGATIONS IN MONTANA
A. J. Boettcher and R. M. Haralick (Kansas Univ., Lawrence) *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1161-1170 refs (For availability see N78-14529 05-43)
Avail: NTIS HC A99/MF A01 CSCL 08H

Thermal infrared imagery was used to locate ground-water inflow along three streams and one lake in Montana. The thermal scanner used in May 1972, March 1973, and November 1975 was mounted in a twin-engined aircraft. On the 1973 and 1975 flights, the data were recorded in an analog format on magnetic tape in flight, later were converted to digital format, and were computer processed using an assignment of patterns to indicate differences in water temperature. Output from the image processing program was converted to a temperature map having an isotherm spacing of 0.5 C. Computerization was found to be the most efficient method to manipulate data from lakes, large rivers, and narrow sinuous streams. Author

N78-14564*# California Univ., Davis. Dept. of Electrical Engineering.
SATELLITE LAND USE ACQUISITION AND APPLICATIONS TO HYDROLOGIC PLANNING MODELS
V. R. Algazi and Minsoo Suk *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1171-1181 refs (For availability see N78-14529 05-43)
Avail: NTIS HC A99/MF A01 CSCL 08H

A developing operational procedure for use by the Corps of Engineers in the acquisition of land use information for hydrologic planning purposes was described. The operational conditions preclude the use of dedicated, interactive image processing facilities. Given the constraints, an approach to land use classification based on clustering seems promising and was explored in detail. The procedure is outlined and examples of application to two watersheds given. Author

N78-14565*# Jahangirnagar Univ., Dacca (Bangladesh). Dept. of Geography.
LAND UTILIZATION AND ECOLOGICAL ASPECTS IN THE SYLHET-MYMENSINGH HAOR REGION OF BANGLADESH: AN ANALYSIS OF LANDSAT DATA
M. I. Chowdhury and K. Maudood Elahi *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1183-1195 refs (For availability see N78-14529 05-43)
Avail: NTIS HC A99/MF A01 CSCL 08B

The use of remote sensing data from LANDSAT (ERTS) imageries in identifying, evaluating and mapping land use patterns of the Haor area in Bangladesh was investigated. Selected cloud free imageries of the area for the period 1972-75 were studied. Imageries in bands 4, 5 and 7 were mostly used. The method of analysis involved utilization of both human and computer services of information from ground, aerial photographs taken during this period and space imageries. Author

N78-14566*# Canada Centre for Remote Sensing, Ottawa (Ontario).
USE OF AERIAL THERMOGRAPHY IN CANADIAN ENERGY CONSERVATION PROGRAMS
J. Cihlar, R. J. Brown, G. Lawrence (Ontario Centre for Remote Sensing), J. N. Barry (Lapp Limited, Toronto, Canada), and R. B. James (Office of Energy Conservation, Ottawa) *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1197-1206 refs (For availability see N78-14529 05-43)
Avail: NTIS HC A99/MF A01 CSCL 08B

Recent developments in the use of aerial thermography in energy conservation programs within Canada were summarized. Following a brief review of studies conducted during the last three years, methodologies of data acquisition, processing, analysis and interpretation was discussed. Examples of results from an industrial oriented project were presented and recommendations for future basic work were outlined. Author

N78-14567*# National Environmental Satellite Service, Washington, D. C.
CAPABILITIES OF OPERATIONAL INFRARED SOUNDING SYSTEMS FROM SATELLITE ALTITUDE
Larry McMillin *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1207-1215 refs (For availability see N78-14529 05-43)
Avail: NTIS HC A99/MF A01 CSCL 04A

Initial attempts at using satellite radiances resulted in the production of temperature profiles similar to those produced by radiosondes. While increases in accuracy were made and additional increases are expected to result from increased instrument capabilities, it was recognized that the production of level temperatures is not consistent with the average temperature that is represented by the radiances. Author

N78-14568*# Aerojet Electrosystems Co., Azusa, Calif.
A MULTICHANNEL PASSIVE MICROWAVE ATMOSPHERIC TEMPERATURE SOUNDING SYSTEM
M. E. Louappe and K. A. Paradis *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1217-1225 refs (For availability see N78-14529 05-43)
(Contract F04701-75-C-0090)
Avail: NTIS HC A99/MF A01 CSCL 04A

The development of a small, lightweight, low-power, seven channel passive microwave radiometer system for use on the Defense Meteorological Satellite Program (DMSP) was described. The 50-60 GHz sensor system operates in the region of an intense atmospheric oxygen absorption band to provide atmospheric temperature profiles to 30 kilometer altitudes on a global basis. Author

N78-14569*# Purdue Univ., Lafayette, Ind. Laboratory for Applications of Remote Sensing.
EVALUATION OF CHANGE DETECTION TECHNIQUES FOR MONITORING COASTAL ZONE ENVIRONMENTS
R. A. Weismiller, S. J. Kristof, D. K. Scholz, P. E. Anuta, and S. M. Momin *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1229-1238 refs (For availability see N78-14529 05-43)
(Contract NAS9-14016)
Avail: NTIS HC A99/MF A01 CSCL 08C

Development of satisfactory techniques for detecting change in coastal zone environments is required before operational monitoring procedures can be established. In an effort to meet this need a study was directed toward developing and evaluating different types of change detection techniques, based upon computer aided analysis of LANDSAT multispectral scanner (MSS) data, to monitor these environments. The Matagorda Bay estuarine system along the Texas coast was selected as the study area. Four change detection techniques were designed and implemented for evaluation: (1) post classification comparison change detection, (2) delta data change detection, (3) spectral/temporal change classification, and (4) layered spectral/temporal change classification. Each of the four techniques was used to analyze a LANDSAT MSS temporal data set to detect areas of change of the Matagorda Bay region. Author

N78-14570*# Environmental Research Inst. of Michigan, Ann Arbor.
WHEAT YEILD FORECASTS USING LANDSAT DATA
John E. Colwell, Daniel P. Rice, and Richard F. Nalepka *In its* Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1245-1254 (For availability see N78-14529 05-43)
(Contract NAS5-22389)
Avail: NTIS HC A99/MF A01 CSCL 02C

Several considerations of winter wheat yield prediction using LANDSAT data were discussed. In addition, a simple technique which permits direct early season forecasts of wheat production was described. Author

N78-14571*# Canada Centre for Remote Sensing, Ottawa (Ontario).
A SOLUTION TO THE PROBLEM OF SAR RANGE CURVATURE
R. K. Raney *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1255-1257 ref (For availability see N78-14529 05-43)
Avail: NTIS HC A99/MF A01 CSCL 17I

When synthetic aperture radar systems are pushed to attain

finer resolution at larger ranges than was previously the case for remote sensing purposes, the geometric signal aberration known as range curvature arises. Known techniques for correcting range curvature are exact at only one selected range, thus forcing neighboring ranges to use the same correction as an approximation. A solution to the problem is proposed that is exact at all ranges, thus simplifying and improving the image processing for such systems. Author

N78-14572*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.

AIRBORNE OCEANOGRAPHIC LIDAR SYSTEM

C. Bressel (Avco-Everett Res. Lab., Inc.), I. Itzkan (Avco-Everett Res. Lab., Inc.), J. E. Nunes (Avco-Everett Res. Lab., Inc.), and F. Hoge *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1259-1268 refs (For availability see N78-14529 05-43)

Avail: NTIS HC A99/MF A01 CSCL 17I

The characteristics of an Airborne Oceanographic Lidar (AOL) are given. The AOL system is described and its potential for various measurement applications including bathymetry and fluorosensing is discussed. Author

N78-14573*# Joint Research Centre of the European Communities, Ispra (Italy).

COMPUTER-AIDED CLASSIFICATION FOR REMOTE SENSING IN AGRICULTURE AND FORESTRY IN NORTHERN ITALY

J. Dejace, J. Megier, and W. Mehl *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1269-1278 refs (For availability see N78-14529 05-43)

Avail: NTIS HC A99/MF A01 CSCL 02C

A set of results concerning the processing and analysis of data from LANDSAT satellite and airborne scanner is presented. The possibility of performing inventories of irrigated crops-rice, planted groves-poplars, and natural forests in the mountians-beeches and chestnuts, is investigated in the Po valley and in an alphine site of Northern Italy. Accuracies around 95% or better, 70% and 60% respectively are achieved by using LANDSAT data and supervised classification. Discrimination of rice varieties is proved with 8 channels data from airborne scanner, processed after correction of the atmospheric effect due to the scanning angle, with and without linear feature selection of the data. The accuracies achieved range from 65% to more than 80%. The best results are obtained with the maximum likelihood classifier for normal parameters but rather close results are derived by using a modified version of the weighted euclidian distance between points, with consequent decrease in computing time around a factor 3. Author

N78-14574*# Environmental Research Inst. of Michigan, Ann Arbor.

THE INFLUENCE OF MULTISPECTRAL SCANNER SPATIAL RESOLUTION ON FOREST FEATURE CLASSIFICATION

F. G. Sadowski, W. A. Malila, J. E. Sarno, and R. F. Nalepka *In its* Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1279-1288 refs Sponsored in part by Dept. of Agriculture. (For availability see N78-14529 05-43)

(Contracts NAS9-14123; NAS9-14988)

Avail: NTIS HC A99/MF A01 CSCL 02F

Inappropriate spatial resolution and corresponding data processing techniques may be major causes for non-optimal forest classification results frequently achieved from multispectral scanner (MSS) data. Procedures and results of empirical investigations are studied to determine the influence of MSS spatial resolution on the classification of forest features into levels of detail or hierarchies of information that might be appropriate for nationwide forest surveys and detailed in-place inventories. Two somewhat different, but related studies are presented. The first consisted of establishing classification accuracies for several hierarchies of features as spatial resolution was progressively coarsened from (2 meters) squared to (64 meters) squared. The second investigated the capabilities for specialized processing techniques to improve upon the results of conventional processing procedures for both coarse and fine resolution data. Author

N78-14575*# GeoSpectra Corp., Ann Arbor, Mich.

REDUCING LANDSAT DATA TO PARAMETERS WITH PHYSICAL SIGNIFICANCE AND SIGNATURE EXTENSION: A VIEW OF LANDSAT CAPABILITIES

Bette C. Salmon-Drexler *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1289-1299 refs Sponsored in part by Bur. of Land Management (For availability see N78-14529 05-43)

(Contract AT(05-1)-1635)

Avail: NTIS HC A99/MF A01 CSCL 05B

The premise is the LANDSAT is capable of sensing only a few physical parameters. Much of the contrast provided in LANDSAT data is provided by differences in vegetation cover. Although dominant, vegetation is not the only physical parameter that can be detected with LANDSAT; a ratio of MSS Channel 5 to MSS Channel 4 (R5,4), two visible channels, separates materials by color hue. Additional information is attained by the addition of MSS channels 5 and 4 to approximate brightness, permitting separation of materials by color value. Other spectral combinations may provide correlations with these physical parameters or new ones. An iron absorption in the infrared can also be recognized in LANDSAT data when iron content is present in sufficient percentages, Although by color, limonite-rich soils are distinctive as bright yellow, they are not unique in the R5,4. A fairly strong iron absorption is present in the infrared band MSS Channel 7 for these soils, although the wideband configuration of LANDSAT is not optimal for its enhancement and the effects of vegetation often obscure it. Author

N78-14576*# Food and Agriculture Organization of the United Nations, Rome (Italy).

AERIAL ALBEDOS OF NATURAL VEGETATION IN SOUTH-EASTERN AUSTRALIA

J. A. Howard *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1301-1307 refs (For availability see N78-14529 05-43)

Avail: NTIS HC A99/MF A01 CSCL 02C

Black-and-white low-level 70mm photography was used to record the track of the aircraft, which was then plotted on conventional 1:80,000 23 cm photogrammetric photographs and referenced against simultaneous measurements of the beam albedos of vegetation. Using stereoscopic pairs of the 70mm photographs, the vegetation was classified into sub-formations. Marked differences in the 'sub-formation' albedos were observed. A two-way table using stand height and crown cover of the sub-formations clearly showed a very distinctive trend of albedos. This finding may be important in other vegetal studies. Author

N78-14577*# Environmental Research Inst. of Michigan, Ann Arbor. Information Systems and Analysis Dept.

BLOB: AN UNSUPERVISED CLUSTERING APPROACH TO SPATIAL PREPROCESSING OF MSS IMAGERY

R. J. Kauth, A. P. Pentland, and G. S. Thomas *In its* Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1309-1317 refs (For availability see N78-14529 05-43)

(Contract NAS9-14988)

Avail: NTIS HC A99/MF A01 CSCL 05B

A basic concept of Multispectral Scanner data processing was developed for use in agricultural inventories; namely, to introduce spatial coordinates of each pixel into the vector description of the pixel and to use this information along with the spectral channel values in a conventional unsupervised clustering of the scene. The result is to isolate spectrally homogeneous field-like patches (called blobs). The spectral mean vector of a blob can be regarded as a defined feature and used in a conventional pattern recognition procedure. The benefits of use are: ease in locating training units in imagery; data compression of from 10 to 30 depending on the application; reduction of scanner noise and consequently potential improvements in classification/proportion estimation performances. Author

N78-14578*# Environmental Research Inst. of Michigan, Ann Arbor. Information Systems and Analysis Dept.

MULTISPECTRAL SYSTEM ANALYSIS THROUGH MODELING AND SIMULATION

W. A. Malila, J. M. Gleason, and R. C. Cicone *In its* Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1319-1328 refs (For availability see N78-14529 05-43)
(Contract NAS-14988)
Avail: NTIS HC A99/MF A01 CSCL 05B

The design and development of multispectral remote sensor systems and associated information extraction techniques should be optimized under the physical and economic constraints encountered and yet be effective over a wide range of scene and environmental conditions. Direct measurement of the full range of conditions to be encountered can be difficult, time consuming, and costly. Simulation of multispectral data by modeling scene, atmosphere, sensor, and data classifier characteristics is set forth as a viable alternative, particularly when coupled with limited sets of empirical measurements. A multispectral system modeling capability is described. Use of the model is illustrated for several applications - interpretation of remotely sensed data from agricultural and forest scenes, evaluating atmospheric effects in LANDSAT data, examining system design and operational configuration, and development of information extraction techniques. Author

N78-14579*# Environmental Research Inst. of Michigan, Ann Arbor.
A 'DIGITAL' TECHNIQUE FOR MANUAL EXTRACTION OF DATA FROM AERIAL PHOTOGRAPHY
Laurence B. Istvan and Mark T. Bondy *In its* Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1329-1336 refs (For availability see N78-14529 05-43)
Avail: NTIS HC A99/MF A01 CSCL 14E

The interpretation procedure described uses a grid cell approach. In addition, a random point is located in each cell. The procedure required that the cell/point grid be established on a base map, and identical grids be made to precisely match the scale of the photographic frames. The grid is then positioned on the photography by visual alignment to obvious features. Several alignments on one frame are sometimes required to make a precise match of all points to be interpreted. This system inherently corrects for distortions in the photography. Interpretation is then done cell by cell. In order to meet the time constraints, first order interpretation should be maintained. The data is put onto coding forms, along with other appropriate data, if desired. This 'digital' manual interpretation technique has proven to be efficient, and time and cost effective, while meeting strict requirements for data format and accuracy. Author

N78-14580*# Consiglio Nazionale delle Ricerche, Milan (Italy). Istituto per la Geophysica della Litosfera.
APPLICATION OF CONVENTIONAL AND ADVANCED TECHNIQUES FOR THE INTERPRETATION OF LANDSAT 2 IMAGES FOR THE STUDY OF LINEARS IN THE FRIULI EARTHQUAKE AREA
P. Cardamone, G. M. Lechi, A. Cavallin (Univ. Degli Studi, Milan), C. M. Marino (Univ. Degli Studi, Milan), and A. Zanferrari (Univ. Degli Studi, Padua) *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1227-1353 refs (For availability see N78-14529 05-43)
Avail: NTIS HC A99/MF A01 CSCL 08K

The results obtained in the study of linears derived from the analysis of LANDSAT 2 images recorded over Friuli during 1975 are described. Particular attention is devoted to the comparison of several passes in different bands, scales and photographic supports. Moreover reference is made to aerial photographic interpretation in selected sites and to the information obtained by laser techniques. Author

N78-14581*# Atomic Energy Establishment, Cairo (Egypt). Remote Sensing Center.
APPLICATION OF LANDSAT SATELLITE IMAGERY FOR IRON ORE PROSPECTING IN THE WESTERN DESERT OF EGYPT
E. M. ElShazly, M. A. AbdelHady, M. A. ElGhawaby, and S. M. Khawasik *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1355-1364 refs (For availability see N78-14529 05-43)
Avail: NTIS HC A99/MF A01 CSCL 08G

Prospecting for iron ore occurrences was conducted by the Remote Sensing Center in Bahariya Oasis-El Faiyum area covering some 100,000 km squared in the Western Desert of Egypt. LANDSAT-1 satellite images were utilized as the main tool in the regional prospecting of the iron ores. The delineation of the geological units and geological structure through the interpretation of the images corroborated by field observations and structural analysis led to the discovery of new iron ore occurrences in the area of investigation. Author

N78-14582*# Atomic Energy Establishment, Cairo (Egypt). Remote Sensing Center.
GROUNDWATER STUDIES IN ARID AREAS IN EGYPT USING LANDSAT SATELLITE IMAGES
E. M. ElShazly, M. A. AbdelHady, and M. M. ElShazly *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1365-1372 refs (For availability see N78-14529 05-43)
Avail: NTIS HC A99/MF A01 CSCL 08H

Various features are interpreted which have strong bearing on groundwater in the arid environment. These include the nature of geological and lithologic units, structural lineaments, present and old drainage systems, distribution and form of water pools, geomorphologic units, weathering surfaces and other weathering phenomena, desert soils, sand dunes and dune sand accumulations, growths of natural vegetation and agriculture, and salt crusts and other expressions of salinization. There are many impressive examples which illustrate the significance of satellite image interpretation on the regional conditions of groundwater which could be traced and interconnected over several tens or even several hundreds of kilometers. This is especially true in the northern Western Desert of Egypt where ground water issuing from deep strata comes to the surface along ENE-WSW and ESE-WNW fault lines and fracture systems. Another striking example is illustrated by the occurrence of fresh to brackish groundwater on the Mediterranean Sea Coastal Zone of the Western Desert where the groundwater is found in the form of lenses floating on the saline sea water. Author

N78-14583*# Environmental Research Inst. of Michigan, Ann Arbor.
APPLICATIONS OF LANDSAT DATA TO THE INTEGRATED ECONOMIC DEVELOPMENT OF MINDORO, PHILLIPINES
T. W. Wagner and J. C. Fernandez (Bur. of Mines, Manila) *In its* Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1375-1380 (For availability see N78-14529 05-43)
Avail: NTIS HC A99/MF A01 CSCL 05C

LANDSAT data is seen as providing essential up-to-date resource information for the planning process. LANDSAT data of Mindoro Island in the Philippines was processed to provide thematic maps showing patterns of agriculture, forest cover, terrain, wetlands and water turbidity. A hybrid approach using both supervised and unsupervised classification techniques resulted in 30 different scene classes which were subsequently color-coded and mapped at a scale of 1:250,000. In addition, intensive image analysis is being carried out in evaluating the images. The images, maps, and aerial statistics are being used to provide data to seven technical departments in planning the economic development of Mindoro. Multispectral aircraft imagery was collected to compliment the application of LANDSAT data and validate the classification results. Author

N78-14584*# Toledo Metropolitan Area Council of Governments, Ohio.
DEVELOPMENT OF AN INTEGRATED DATA BASE FOR LAND USE AND WATER QUALITY PLANNING
John Adams, Chris VanSchayk, and Laurence B. Istvan (ERIM) *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1381-1386 (For availability see N78-14529 05-43)
Avail: NTIS HC A99/MF A01 CSCL 08B

To help understand the role played by different land resources in water quality management a computer based data system was created. The Land Resource Information System (LRIS) allows data to be readily retrieved or statistically analyzed for a variety of purposes. It is specifically formatted to perform coordination of water quality data with logy, etc. New understanding of the

region gained through the use of LRIS has gone well beyond the initial purpose of assessing water quality conditions. The land use and natural features information has provided a well defined starting point for a systematic evaluation of proposed land uses, transportation, housing, and other public investments. It has laid the foundation for a comprehensive and integrated approach to many different planning and investment programs presently underway. Author

N78-14585*# National Weather Service, Camp Springs, Md. Spaceflight Meteorology Group.

METEOROLOGICAL SUPPORT FOR REMOTE SENSING PROGRAMS

James L. Cox *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1387-1396 (For availability see N78-14529 05-43)

Avail: NTIS HC A99/MF A01 CSCL 04B

Many earth-oriented remote sensing spacecraft and aircraft programs are affected by the presence of clouds. Like aerial photography, they require clear or mostly clear skies. To cope with the cloud problem, the National Weather Service through its Spaceflight Meteorology Group (SMG) of the Space Operations Support Division makes cloud cover forecasts, as part of its specialized weather service for various NASA remote sensing and other programs. Forecasting requirements vary in time from a few hours out to several days and in aerial extent from a particular locality to nearly global in coverage. Depending on the stage of program development, some remote sensing programs may involve special climatological studies for planning purposes or need ground-truth data for comparison with remotely sensed information. The importance of computer and weather satellite products to the SMG meteorologist is discussed and the nature of SMG's weather support of past, present, and future remote sensing programs is described. Author

N78-14586*# Institute of Ocean Sciences, Victoria (British Columbia).

USE OF AN INERTIAL NAVIGATION SYSTEM FOR ACCURATE TRACK RECOVERY AND COASTAL OCEANOGRAPHIC MEASUREMENTS

B. M. Oliver and J. F. R. Gower *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1399-1413 refs (For availability see N78-14529 05-43)

Avail: NTIS HC A99/MF A01 CSCL 17G

A data acquisition system using a Litton LTN-51 inertial navigation unit (INU) was tested and used for aircraft track recovery and for location and tracking from the air of targets at sea. The characteristic position drift of the INU is compensated for by sighting landmarks of accurately known position at discrete time intervals using a visual sighting system in the transparent nose of the Beechcraft 18 aircraft used. For an aircraft altitude of about 300 m, theoretical and experimental tests indicate that calculated aircraft and/or target positions obtained from the interpolated INU drift curve will be accurate to within 10 m for landmarks spaced approximately every 15 minutes in time. For applications in coastal oceanography, such as surface current mapping by tracking artificial targets, the system allows a broad area to be covered without use of high altitude photography and its attendant needs for large targets and clear weather. Author

N78-14587*# Wisconsin Univ., Madison.

LAKE WATER QUALITY MAPPING FROM LANDSAT

James P. Scherz *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1417-1425 refs (For availability see N78-14529 05-43)

(Contract NAS5-20942; Grant NGL-50-002-127)

Avail: NTIS HC A99/MF A01 CSCL 08H

The lakes in three LANDSAT scenes were mapped by the Bendix MDAS multispectral analysis system. Field checking the maps by three separate individuals revealed approximately 90-95% correct classification for the lake categories selected. Variations between observers was about 5%. From the MDAS color coded maps the lake with the worst algae problem was easily located. This lake was closely checked and a pollution source of 100 cows was found in the springs which fed this lake. The theory, lab work and field work which made it possible for this demonstration project to be a practical lake classification procedure are presented. Author

N78-14588*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

DISSEMINATING TECHNOLOGICAL INFORMATION ON REMOTE SENSING TO POTENTIAL USERS

James D. Russell and John C. Lindenlaur *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1427-1432 refs (For availability see N78-14529 05-43)

Avail: NTIS HC A99/MF A01 CSCL 05B

The Laboratory for Applications of Remote Sensing developed materials and programs which range from short tutorial brochures to post-doctoral research programs which may span several years. To organize both the content and the instructional techniques, a matrix of instructional materials was conceptualized. Each row in the matrix represents a subject area in remote sensing and each column in the matrix represents a different type media or instructional strategy. Author

N78-14589*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

SPACE SHUTTLE SEARCH AND RESCUE EXPERIMENT USING SYNTHETIC APERTURE RADAR

W. E. Sivertson, Jr., R. W. Larson (ERIM), and J. S. Zelenka (Sci. Appl., Inc., Tucson, Ariz.) *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1433-1443 refs Presented at WESCON/76 (For availability see N78-14529 05-43)

Avail: NTIS HC A99/MF A01 CSCL 17I

The feasibility of a synthetic aperture radar for search and rescue applications was demonstrated with aircraft experiments. One experiment was conducted using the ERIM four-channel radar and several test sites in the Michigan area. In this test simple corner-reflector targets were successfully imaged. Results from this investigation were positive and indicate that the concept can be used to investigate new approaches focused on the development of a global search and rescue system. An orbital experiment to demonstrate the application of synthetic aperture radar to search and rescue is proposed using the space shuttle. Author

N78-14590*# Battelle Pacific Northwest Labs., Richland, Wash.

PROTOTYPE ACTIVE SCANNER FOR NIGHTTIME OIL SPILL MAPPING AND CLASSIFICATION

G. A. Sandness and S. B. Ailes *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1445-1452 Sponsored in part by EPA and Coast Guard (For availability see N78-14529 05-43)

Avail: NTIS HC A99/MF A01 CSCL 13B

A prototype, active, aerial scanner system was constructed for nighttime water pollution detection and nighttime multispectral imaging of the ground. An arc lamp was used to produce the transmitted light and four detector channels provided a multispectral measurement capability. The feasibility of the design concept was demonstrated by laboratory and flight tests of the prototype system. Author

N78-14591*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

AIRBORNE MONITORING OF CROP CANOPY TEMPERATURES FOR IRRIGATION SCHEDULING AND YIELD PREDICTION

John P. Millard, Ray D. Jackson (Agricultural Res. Serv., Phoenix, Ariz.), Robert C. Goettelman (LFE Corp., Richmond, Calif.), Robert J. Reginato (Agricultural Res. Serv., Phoenix, Ariz.), Sherwood B. Idso (Agricultural Res. Serv., Phoenix, Ariz.), and Richard L. LaPado (ESL, Inc.) *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1453-1461 refs (For availability see N78-14529 05-43)

Avail: NTIS HC A99/MF A01 CSCL 02C

Airborne and ground measurements were made on April 1 and 29, 1976, over a USDA test site consisting mostly of wheat in various stages of water stress, but also including alfalfa and bare soil. These measurements were made to evaluate the feasibility of measuring crop temperatures from aircraft so that a parameter termed stress degree day, SDD, could be computed.

Ground studies have shown that SDD is a valuable indicator of a crop's water needs, and that it can be related to irrigation scheduling and yield. The aircraft measurement program required predawn and afternoon flights coincident with minimum and maximum crop temperatures. Airborne measurements were made with an infrared line scanner and with color IR photography. The scanner data were registered, subtracted, and color-coded to yield pseudo-colored temperature-difference images. Pseudo-colored images reading directly in daily SDD increments were also produced. These maps enable a user to assess plant water status and thus determine irrigation needs and crop yield potentials. Author

N78-14592*# Geological Survey, Denver, Colo.
DIGITAL COLOR ANALYSIS OF COLOR-RATIO COMPOSITE LANDSAT SCENES
Gary L. Raines *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1463-1472 refs (For availability see N78-14529 05-43)
Avail: NTIS HC A99/MF A01 CSCL 05B

A method is presented that can be used to calculate approximate Munsell coordinates of the colors produced by making a color composite from three registered images. Applied to the LANDSAT MSS data of the Goldfield, Nevada, area, this method permits precise and quantitative definition of the limonitic areas originally observed in a LANDSAT color ratio composite. In addition, areas of transported limonite can be discriminated from the limonite in the hydrothermally altered areas of the Goldfield mining district. From the analysis, the numerical distinction between limonitic and nonlimonitic ground is generally less than 3% using the LANDSAT bands and as much as 8% in ratios of LANDSAT MSS bands. Author

N78-14593*# International Business Machines Corp., Houston, Tex. Federal Systems Div.
LANDSAT DATA FROM AGRICULTURAL SITES: CROP SIGNATURE ANALYSIS
P. N. Misra and S. G. Wheeler *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1473-1482 refs (For availability see N78-14529 05-43) (Contract NAS9-14350)
Avail: NTIS HC A99/MF A01 CSCL 02C

The LANDSAT multispectral scanner (MSS) data were analyzed with a view toward classification to identify wheat. The notion of spectral signature of a crop, a commonly used basis for classification, was found to be inadequate. Data analysis has revealed that the MSS data from agricultural sites were essentially two dimensional, and that the data from different sites and different acquisition lay on parallel planes in the four dimensional feature space. These results were exploited to gain new insight into the data and to develop alternate models for classification. In particular, it was found that the temporal pattern of change in the spectral response of a crop constitutes its signature and provides a basis for crop classification. Author

N78-14594*# Centre d'Etude Spatiale des Rayonnements, Toulouse (France).
INVENTORY OF RICEFIELDS IN FRANCE USING LANDSAT AND AIRCRAFT
T. LeToan, P. Cassirame, J. Quach, and R. Marie (Inst. Natl. de Rech. Agron., Montpellier, France) *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1483-1495 refs (For availability see N78-14529 05-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The methodology for mapping ricefields in Southern France is developed, using 1975 LANDSAT 2 and aircraft data and taking into account the features of the fields. Author

N78-14595*# Forest Service, Upper Darby, Pa.
FORESTLAND TYPE IDENTIFICATION AND ANALYSIS IN WESTERN MASSACHUSSETTS: A LINKAGE OF A LANDSAT FOREST INVENTORY TO AN OPTIMIZATION STUDY
Giles T. Rafsnider, Robert H. Rogers (Bendix Corp., Ann Arbor, Mich.), and Anthony Morse (Bendix Corp., Ann Arbor, Mich.) *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1497-1505 refs (For availability see N78-14529 05-43)
Avail: NTIS HC A99/MF A01 CSCL 02F

Digital land cover files derived from computer processing of LANDSAT and soil productivity data were linked and used by linear programming model to determine production of forested areas under different management strategies. Results of model include maps and data graphics for four-county region in Western Massachusetts. Author

N78-14596*# Nevada Univ., Reno.
LARGE SCALE 20mm PHOTOGRAPHY FOR RANGE RESOURCES ANALYSIS IN THE WESTERN UNITED STATES
Paul T. Tueller *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1507-1514 refs (For availability see N78-14529 05-43)
Avail: NTIS HC A99/MF A01 CSCL 14E

Large scale 70mm aerial photography is a valuable supplementary tool for rangeland studies. A wide assortment of applications were developed varying from vegetation mapping to assessing environmental impact on rangelands. Color and color infrared stereo pairs are useful for effectively sampling sites limited by ground accessibility. They allow an increased sample size at similar or lower cost than ground sampling techniques and provide a permanent record. Author

N78-14597*# Weyerhauser Co., Plymouth, N. C.
ASSESSMENT OF FOREST PLANTATIONS FROM LOW ALTITUDE AERIAL PHOTOGRAPHY
Harold A. Nelson *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1515-1522 (For availability see N78-14529 05-43)
Avail: NTIS HC A99/MF A01 CSCL 02F

Vertical color, and color-infrared, aerial photography obtained from altitudes between 183 m and 915 m provide a cost effective method of determining tree survival and height growth in pine plantations on the North Carolina Coastal Plain. All interpretations were performed by professional forestry personnel from the original 70 mm color transparencies. Prompt assessment of tree survival is necessary if failed spots are to be successfully replanted. Counts of living trees made after the third growing season, and sometimes only two growing seasons after planting, are accurate enough to permit planning of replanting operations without extensive ground surveys. Author

N78-14598*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
PERFORMANCE TESTS OF SIGNATURE EXTENSION ALGORITHMS
R. A. Abotteen, S. Levy, M. Mendlowitz, T. Moritz, J. Potter, S. Thadani, and O. A. Wehmanen *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1523-1532 refs (For availability see N78-14529 05-43) (Contract NAS9-15200)
Avail: NTIS HC A99/MF A01 CSCL 12A

Comparative tests were performed on seven signature extension algorithms to evaluate their effectiveness in correcting for changes in atmospheric haze and sun angle in a LANDSAT scene. Four of the algorithms were cluster matching, and two were maximum likelihood algorithms. The seventh algorithm determined the haze level in both training and recognition segments and used a set of tables calculated from an atmospheric model to determine the affine transformation that corrects the training signatures for changes in sun angle and haze level. Three of the algorithms were tested on a simulated data set, and all of the algorithms were tested on consecutive-day data. Author

N78-14599*# Atomic Energy Establishment, Cairo (Egypt). Remote Sensing Center.
INTERPRETATION OF MULTISPECTRAL AND INFRARED THERMAL SURVEYS OF THE SUEZ CANAL ZONE, EGYPT
E. M. ElShazly, M. A. Abdel Hady Hady, M. A. Abdel Hafez, A. B. Salman, M. A. Morsy, M. M. elRakaiby, I. E. E. alAassy, and A. F. Kamel *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1533-1542 refs (For availability see N78-14529 05-43)
Avail: NTIS HC A99/MF A01 CSCL 17E

Remote sensing airborne surveys were conducted, as part

of the plan of rehabilitation, of the Suez Canal Zone using I2S multispectral camera and Bendix LN-3 infrared passive scanner. The multispectral camera gives four separate photographs for the same scene in the blue, green, red, and near infrared bands. The scanner was operated in the microwave bands of 8 to 14 microns and the thermal surveying was carried out both at night and in the day time. The surveys, coupled with intensive ground investigations, were utilized in the construction of new geological, structural lineation and drainage maps for the Suez Canal Zone on a scale of approximately 1:20,000, which are superior to the maps made by normal aerial photography. A considerable number of anomalies belonging to various types were revealed through the interpretation of the executed multispectral and infrared thermal surveys. Author

N78-14600*# Geological Survey, Suffolk, Va.
THREE APPROACHES TO THE CLASSIFICATION OF INLAND WETLANDS
Patricia T. Gammon, Donald Malone (Tenn. Valley Authority, Chattanooga), Paul D. Brooks, and Virginia Carter *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1545-1555 refs (For availability see N78-14529 05-43)
Avail: NTIS HC A99/MF A01 CSCL 08B

In the Dismal Swamp project, seasonal, color-infrared aerial photographs and LANDSAT digital data were interpreted for a detailed analysis of the vegetative communities in a large, highly altered wetland. In Western Tennessee, seasonal high altitude color-infrared aerial photographs provided the hydrologic and vegetative information needed to map inland wetlands, using a classification system developed for the Tennessee Valley Region. In Florida, color-infrared aerial photographs were analyzed to produce wetland maps using three existing classification systems to evaluate the information content and mappability of each system. The methods used in each of the three projects can be extended or modified for use in the mapping of inland wetlands in other parts of the United States. Author

N78-14601*# Kansas Univ., Lawrence. Remote Sensing Lab.
ESTIMATION OF SOIL MOISTURE WITH RADAR REMOTE SENSING
Percy P. Batlivala and Fawwaz T. Ulaby *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1557-1566 refs (For availability see N78-14529 05-43)
Avail: NTIS HC A99/MF A01 CSCL 08M

The radar response to soil moisture content was investigated using a truck-mounted 1-18 GHz (30-1.67 cm wavelength, respectively) active microwave spectrometer (MAS) system. The sensitivity to soil moisture content and the accuracy with which it could be estimated were evaluated for both bare and vegetation-covered fields. Bare field experiments were conducted to determine the optimum radar parameters (frequency, angle of incidence range, and polarization configuration) for minimizing the response to surface roughness while retaining strong sensitivity to moisture content. In the vegetation-covered case, the effects of crop type, crop height and row direction relative to the radar look direct were evaluated. Author

N78-14602*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
QUANTIFICATION OF SOIL MAPPING BY DIGITAL ANALYSIS OF LANDSAT DATA
F. R. Kirschner (Soil Conservation Service, Indianapolis, Ind.), S. A. Kaminsky, E. J. Hinzel, H. R. Sinclair (Soil Conservation Service, Indianapolis, Ind.), and R. A. Weismiller *In* ERIM Proc. of the Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1567-1573 refs (For availability see N78-14529 05-43)
(Grant NGL-15-005-186)
(Rept-6690) Avail: NTIS HC A99/MF A01 CSCL 08B

Soil survey mapping units are designed such that the dominant soil represents the major proportion of the unit. At times, soil mapping delineations do not adequately represent conditions as stated in the mapping unit descriptions. Digital analysis of LANDSAT multispectral scanner (MSS) data provides a means of accurately describing and quantifying soil mapping unit composition. Digital analysis of LANDSAT MSS data collected on 9 June 1973 was used to prepare a spectral soil map for a 430-hectare area in Clinton County, Indiana. Fifteen spectral classes were defined, representing 12 soil and 3 vegetation classes. The 12 soil classes were grouped into 4 moisture regimes based upon their spectral responses; the 3 vegetation classes were grouped into one all-inclusive class. Author

N78-14603*# Office of the Chief of Engineers (Army), Washington, D. C.
APPLICATIONS OF THERMAL INFRARED IMAGERY FOR ENERGY CONSERVATION AND ENVIRONMENTAL SURVEYS
James R. Carney, Theodore C. Vogel (Army Engr. Topographic Labs., Fort Belvoir, Va.), Gordon E. Howard (EPA, Warrenton, Va.), and Earl R. Love (Facilities Eng. Support Center, Fort Belvoir, Va.) *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1575-1588 refs (For availability see N78-14529 05-43)
Avail: NTIS HC A99/MF A01 CSCL 05B

The survey procedures, developed during the winter and summer of 1976, employ color and color infrared aerial photography, thermal infrared imagery, and a handheld infrared imaging device. The resulting imagery was used to detect building heat losses, deteriorated insulation in built-up type building roofs, and defective underground steam lines. The handheld thermal infrared device, used in conjunction with the aerial thermal infrared imagery, provided a method for detecting and locating those roof areas that were underlain with wet insulation. In addition, the handheld infrared device was employed to conduct a survey of a U.S. Army installation's electrical distribution system under full operating loads. This survey proved to be cost effective procedure for detecting faulty electrical insulators and connections that if allowed to persist could have resulted in both safety hazards and loss in production. Author

N78-14604*# National Environmental Satellite Service, Suitland, Md.
THE OPERATIONAL PROCESSING OF WIND ESTIMATES FROM CLOUD MOTIONS: PAST, PRESENT AND FUTURE
C. Novak and M. Young *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1589-1598 refs (For availability see N78-14529 05-43)
Avail: NTIS HC A99/MF A01 CSCL 04B

Current NESS winds operations provide approximately 1800 high quality wind estimates per day to about twenty domestic and foreign users. This marked improvement in NESS winds operations was the result of computer techniques development which began in 1969 to streamline and improve operational procedures. In addition, the launch of the SMS-1 satellite in 1974, the first in the second generation of geostationary spacecraft, provided an improved source of visible and infrared scanner data for the extraction of wind estimates. Currently, operational winds processing at NESS is accomplished by the automated and manual analyses of infrared data from two geostationary spacecraft. This system uses data from SMS-2 and GOES-1 to produce wind estimates valid for 00Z, 12Z and 18Z synoptic times. Author

N78-14605*# Aerojet Electrosystems Co., Azusa, Calif.
DATA PROCESSING FOR THE DMSP MICROWAVE RADIOMETER SYSTEM
J. L. Rigone and A. P. Stogryn *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1599-1608 (For availability see N78-14529 05-43)
Avail: NTIS HC A99/MF A01 CSCL 05B

A software program was developed and tested to process microwave radiometry data to be acquired by the microwave sensor (SSM/T) on the Defense Meteorological Satellite Program spacecraft. The SSM/T 7-channel microwave radiometer and systems data will be data-linked to Air Force Global Weather Central (AFGWC) where they will be merged with ephemeris data prior to product processing for use in the AFGWC upper air data base (UADB). The overall system utilizes an integrated design to provide atmospheric temperature soundings for global applications. The fully automated processing at AFGWC was accomplished by four related computer processor programs to produce compatible UADB soundings, evaluate system performance, and update the a priori developed inversion matrices. Tests

with simulated data produced results significantly better than climatology. Author

N78-14606*# Louisiana State Univ., Baton Rouge. Coastal Studies Inst

SURFACE TEMPERATURES AND TEMPERATURE GRADIENT FEATURES OF THE US GULF COAST WATERS

Oscar K. Huh, Lawrence J. Rouse, Jr., and Glenn W. Smith *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1609-1618 ref (For availability see N78-14529 05-43)

Avail: NTIS HC A99/MF A01 CSCL 08C

Satellite thermal infrared data on the Gulf of Mexico show that a seasonal cycle exists in the horizontal surface temperature structure. In the fall, the surface temperatures of both coastal and deep waters are nearly uniform. With the onset of winter, atmospheric cold fronts, which are accompanied by dry, low temperature air and strong winds, draw heat from the sea. A band of cooler water forming on the inner shelf expands, until a thermal front develops seaward along the shelf break between the cold shelf waters and the warmer deep waters of the Gulf. Digital analysis of the satellite data was carried out in an interactive mode using a minicomputer and software. A time series of temperature profiles illustrates the temporal and spatial changes in the sea-surface temperature field. Author

N78-14607*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

MULTISPECTRAL ANALYSIS OF OCEAN DUMPED MATERIALS

Robert W. Johnson *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1619-1627 refs (For availability see N78-14529 05-43)

Avail: NTIS HC A99/MF A01 CSCL 14E

Experiments conducted in the Atlantic coastal zone indicated that plumes resulting from ocean dumping of acid wastes and sewage sludge have unique spectral characteristics. Remotely sensed wide area synoptic coverage provided information on these pollution features that was not readily available from other sources. Aircraft remotely sensed photographic and multispectral scanner data were interpreted by two methods. First, qualitative analyses in which pollution features were located, mapped, and identified without concurrent sea truth and, second, quantitative analyses in which concurrently collected sea truth was used to calibrate the remotely sensed data and to determine quantitative distributions of one or more parameters in a plume. Author

N78-14608*# Battelle Pacific Northwest Labs., Richland, Wash.

DETECTION, IDENTIFICATION, AND QUANTIFICATION TECHNIQUES FOR SPILLS OF HAZARDOUS CHEMICALS

J. F. Washburn and G. A. Sandness *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1629-1635 (For availability see N78-14529 05-43) (Contract DOT-CG-54323-A)

Avail: NTIS HC A99/MF A01 CSCL 13B

The first 400 chemicals listed in the Coast Guard's Chemical Hazards Response Information System were evaluated with respect to their detectability, identifiability, and quantifiability by 12 generalized remote and in situ sensing techniques. Identification was also attempted for some key areas in water pollution sensing technology. Author

N78-14609*# Leningrad (A. A. Zhdanov) State Univ. (USSR). Dept. of Atmospheric Physics.

PASSIVE MICROWAVE REMOTE SENSING OF SOIL MOISTURE

K. Ya. Kondratyev, V. V. Melentyev, Yu. I. Rabinovich, and E. M. Shulgina *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 2 1977 p 1637-1661 refs (For availability see N78-14529 05-43)

Avail: NTIS HC A99/MF A01 CSCL 08M

The theory and calculations of microwave emission from the medium with the depth-dependent physical properties are discussed; the possibility of determining the vertical profiles of temperature and humidity is considered. Laboratory and aircraft measurements of the soil moisture are described; the technique for determining the productive-moisture content in soil, and the results of aircraft measurements are given. Author

N78-14610# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

APPLICATION OF REMOTE SENSING TO GEOTHERMAL ANOMALY MAPPING IN THE CALDAS NOVAS COUNTY, GOIAS M.S. Thesis [APLICACAO DE SENSORIAMENTO REMOTO NO ESTUDO DE ANOMALIA GEOTERMAL NO MUNICIPIO DE CALDAS NOVAS, GOIAS]

Celio Eustaquio DosAnjos Oct. 1977 173 p refs In PORTUGUESE; ENGLISH summary

(INPE-1129-TPT/070) Avail: NTIS HC A08/MF A01

The geothermal anomaly of Caldas Novas county in the state of Goias was mapped. Systematic research was carried out combining geological mapping with surface and subsurface temperature measurements. LANDSAT-1 images of the region were studied allowing the placement of the area in regional geological context. The origins and evolution of the geothermal anomaly were also considered. Geological mapping was done to the scale of 1:60 using USAF aerial photography. Regional temperature mapping was done using trend surface analysis. Through the correlation of these data, four different areas were localized which have a high potential for hot water prospecting. Author

N78-14611# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

APPLICATION OF REMOTE SENSING TO GEOLOGICAL AND MINERAL DEPOSITS SURVEYS OF THE NORTHERN MINAS GERAIS STATE, UTILIZING IMAGES FROM LANDSAT [APLICACAO DE SENSORES REMOTOS PARA LEVANTAMENTOS GEOLOGICOS E DE RECURSOS MINERAIS COM BASE NAS IMAGENS LANDSAT NO NORTE DE MINAS GERAIS]

Roberto Pereira DaCunha and Juercio Tavares DeMattos Aug. 1977 70 p refs In PORTUGUESE, ENGLISH summary Presented at the 7th Simp. Brasil. de Mineracao, Porto Alegre, Brazil, 31 Jul. - 5 Aug. 1977

(INPE-1096-PE/073) Avail: NTIS HC A04/MF A01

Results are presented from a study of application of remote sensing to the survey of regional geology of the northern Minas Gerais state and part of the state of Goias. Images from LANDSAT, RADAR, aerophotographs, magnetometric maps and automatic interpretation of computer compatible tapes (CCT's) of the LANDSAT were used. Regional geology, mineral resources of a 143.000 sq km, area, and results obtained with the help of different sensors are presented for the area under the study. Author

N78-14612# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.

REMOTE SENSING: A PARTIAL TECHNOLOGY Final Report, 1 Jun. 1976 - 31 May 1977

George J. Zissis May 1977 790 p

(Contract NSF ERS-76-14462)

(PB-271278/4; ERIM-123600-1-F; NSF/RA-770167) Avail: NTIS HC A99/MF A01 CSCL 08F

A partial assessment of remote sensing technology is provided, intended to: (1) define and structure the technology assessment problem; (2) compile the necessary data bases; (3) identify some possible impacts as they relate to remote sensing technology, with emphasis on the visible and infrared portions of the electromagnetic spectrum, especially in satellite systems like LANDSAT; (4) develop an assessment procedure; and (5) do a few pilot analyses to test the merits of this procedure. GRA

N78-14613# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INCREASE IN THE FIDELITY OF IMAGE DURING THE PRODUCTION OF DIAPOSITIVES

O. V. Portnova 22 Apr. 1977 19 p Transl. into ENGLISH from Geod. i Kartografiya (Moscow), no. 5, May 1972 p 44-47

(AD-A046226; FTD-ID(RS)T-0325-77; FTD-77-C-000430) Avail: NTIS HC A02/MF A01 CSCL 14/5

The task of improving the quality of materials of aerial photography and their treatment was considered in regard to large scale stereotopographic photography. Distortions of images on aerial photographs were examined as they appear in the

process of photographing the locality and in the process of producing diapositives in a contact manner. Author (GRA)

N78-14614# Illinois Univ., Urbana-Champaign. Dept. of Civil Engineering.

AUTOMATIC SOIL CLASSIFICATION USING QUANTITATIVE TERRAIN FACTORS Final Report, 15 Mar. 1974 - 20 Jul. 1977

Kam W. Wong 20 Jul. 1977 33 p refs

(Grants DAHC04-74-G-0135; DAAG29-74-G-0135; DA Proj. 1T1-61102-BH-57)

(AD-A045978; UILU-ENG-77-2014; ARO-11597.2-GS) Avail: NTIS HC A03/MF A01 CSCL 08/13

A success rate of 60 to 80% was achieved in identifying the soil parent materials of sample areas from among several highly similar parent materials. Only quantitative terrain factors, which were computed from digital elevation and drainage data, were used for discriminating the soil parent materials from each other. The results clearly demonstrated that a reliable method of automatic soil mapping is now technically feasible. Nine soil associations from the state of Illinois and one each from the states of Indiana, Nebraska and Kentucky were used in the study. Eleven commonly used terrain factors were modified for efficient computation using electronic computer, and standard univariate and multivariate analysis techniques were used for testing and classification. Drainage density and surface variance, which is a statistical measure of surface relief, were found to be the most efficient factors for discriminating the soil parent materials. Author (GRA)

N78-14615# California Univ., Berkeley. Lawrence Berkeley Lab.

GEOLOGICAL REMOTE SENSING FROM SPACE

F. B. Henderson, III and G. A. Swann 1976 74 p

(Contract W-7405-eng-48)

(TID-27689) Avail: NTIS HC A04/MF A01

Remote sensing from space, offering many advantages to assist in the geological and geophysical mapping of the earth was investigated. Geological parameters, including structural interpretation, rock, mineral, soil, and vegetation discrimination and identification, and alteration studies were considered. Present or potential space sensing capabilities were compared to these parameters for maximum geological utilization. Application capabilities were differentiated from experimental capabilities. Geological parameters for oil, gas and mineral exploration and for engineering and environmental geology were delineated. Major potential applications not available from current or past space technology were recognized while geological parameters and corresponding potential GEOSAT capabilites were summarized. ERA

N78-14616# California Univ., Berkeley. Lawrence Berkeley Lab.

RECENT DEVELOPMENTS IN MODELING GROUNDWATER SYSTEMS

T. N. Narasimhan and P. A. Witherspoon 20 May 1977 34 p refs

(Contract W-7405-eng-48)

(LBL-5209) Avail: NTIS HC A03/MF A01

Developments in the mathematical modeling of groundwater systems over the past decade are reviewed. The physics of the different types of problems that are of interest in hydrogeology and a statement of the related initial-boundary value problems are described. The various numerical techniques that have been employed to solve the governing equations are discussed and a few typical case histories are presented to illustrate the trend of progress that has occurred in the application of mathematical modeling to actual field problems. ERA

N78-14617# Centre National d'Etudes Spatiales, Toulouse (France).

TEST SYSTEM FOR EARTH OBSERVATION - SPOT. VOLUME 1: SYSTEMS ANALYSIS AND DEVELOPMENT PLAN [SYSTEME PROBATOIRE D'OBSERVATION DE LA TERRE SPOT. VOLUME 1. ANALYSE SYSTEME ET PLAN DE DEVELOPPEMENT]

Mar. 1977 400 p In FRENCH 5 Vol.

Avail: NTIS HC A17/MF A01

A study is presented of an earth observation satellite program, SPOT. The spacecraft consists of a multimission platform and a payload, which for the first mission will be for land use observation. A launch using Ariane is foreseen for 1983. Mission profile and constraints are discussed, and a systems analysis for the first mission is described. General principles of project management are dealt with. They cover the roles of CNES and ESA in the project. A development and test plan is proposed and a cost analysis presented. ESA

N78-14618# Centre National d'Etudes Spatiales, Toulouse (France).

TEST SYSTEM FOR EARTH OBSERVATION - SPOT. VOLUME 3: MULTIMISSION PLATFORM - SUBSYSTEMS [SYSTEME PROBATOIRE D'OBSERVATION DE LA TERRE SPOT. VOLUME 3. PLATEFORME MULTIMISSIONS SOUSSYSTEMES]

Mar. 1977 535 p refs In FRENCH 5 Vol.

Avail: NTIS HC A23/MF A01

The design of the subsystems for the platform is discussed. A semimodular version of the structural subsystem was gauged and a dynamic analysis carried out in view of decoupling from launcher and other subsystems. A modular version was also gauged and, although no dynamic analysis was performed, it was estimated that decoupling performance is as good. In examining the thermal control subsystem, it was found that the new problems created by this satellite are due to the high power dissipation. The solar generator drive and the power supply subsystem were investigated. Problems posed by electrical distribution, EMC, TTC, onboard processing, and attitude/orbit control are dealt with. ESA

N78-14619# Centre National d'Etudes Spatiales, Toulouse (France).

TEST SYSTEM FOR EARTH OBSERVATION - SPOT. VOLUME 4: FIRST MISSION PAYLOAD [SYSTEME PROBATOIRE D'OBSERVATION DE LA TERRE SPOT. VOLUME 4. CHARGE UTILE PREMIERE MISSION]

Mar. 1977 572 p In FRENCH Original contains color illustrations 5 Vol.

Avail: NTIS HC A24/MF A01

The first mission payload is comprised of two instruments allowing earth observation along the satellite's vertical. The first instrument, MRVIR, supplies images in the visible and infrared range, and its resolution is average (80 m in the visible range); the field is 140 km. The second instrument, HRV, supplies images in the visible range with a resolution of 20 m and a field of 60 km. Some technical and technological problems of the instruments are identified: scanning and associated electronics, detector strips and their positioning, and the low noise pre-amplifier. ESA

N78-14620# Centre National d'Etudes Spatiales, Toulouse (France).

TEST SYSTEM FOR EARTH OBSERVATION - SPOT. VOLUME 4BIS: FIRST MISSION PAYLOAD AND MICROWAVE PAYLOAD, COMPATIBILITY STUDY [SYSTEME PROBATOIRE D'OBSERVATION DE LA TERRE SPOT. VOLUME 4BIS. CHARGE UTILE PREMIERE MISSION]

Mar. 1977 138 p refs In FRENCH 5 Vol.

Avail: NTIS HC A07/MF A01

The first payload telemetry and possible microwave payloads were studied for the SPOT system. The feasibility of an 8 GHz telemetry was investigated for ground and space segment. An analysis is presented of passive and active microwave equipment which may be used as payload during later missions. ESA

N78-14621# Centre National d'Etudes Spatiales, Toulouse (France).

TEST SYSTEM FOR EARTH OBSERVATION - SPOT. VOLUME 5: MULTIPURPOSE GROUND FACILITIES AND DEDICATED IMAGE STATIONS [SYSTEME PROBATOIRE D'OBSERVATION DE LA TERRE SPOT. VOLUME 5. MOYENS SOL DE SERVITUDE ET D'ACQUISITION D'IMAGE]

Mar. 1977 100 p In FRENCH 5 Vol.

Avail: NTIS HC A05/MF A01

Ground facilities and image acquisition stations for the SPOT system are analyzed. The layout of ground facilities is based on

the concept of an interface between the spaceborne platform and the users of imagery produced. The role of the command and control center is outlined, together with that of a dedicated image system. ESA

N78-14622# Earth Satellite Corp., Washington, D. C.
DEVELOPMENT OF AIRBORNE ELECTROMAGNETIC SURVEY INSTRUMENTATION AND APPLICATION TO THE SEARCH FOR BURIED SAND AND GRAVEL, A SUMMARY REPORT
O. R. Russell, J. R. Everett, and J. A. Uncapher Jan. 1977 27 p refs
(Contract DOT-FH-11-9144)
(PB-271331/1; FHWA-RD-77-35) Avail: NTIS HC A03/MF A01 CSCL 08I

Airborne electromagnetic survey systems, developed 30 years ago in Canada, have mostly been used in exploration for metallic mineral deposits. In the last 10 years there has been some use of the systems for looking at surface material types and exploring for sand and gravel. The results of this work are extremely encouraging; however, the body of experience is as yet limited. The three systems which appear to have the greatest potential in exploration for sand and gravel are E-Phase, INPUT, and Dighem. All of these rely on radio frequencies in the very low frequency range. Each has been used to locate sand and gravel under specific sets of conditions. GRA

N78-14623# Purdue Univ., Lafayette, Ind. Water Resources Research Center.
STUDIES IN FLUVIAL GEOMORPHOLOGY. NO. 4: MORPHOLOGY AND MORPHOMETRY OF A CHANNELIZED STREAM: THE CASE HISTORY OF BIG PINE CREEK DITCH, BENTON COUNTY, INDIANA
Robert S. Barnard Jun. 1977 111 p refs
(Contract DI-14-34-0001-6015; OWRT Proj. A-035-IND(1))
(PB-272468/0; PUR-WRRC-TR-92; TR-92; W77-11939) Avail: NTIS HC A06/MF A01 CSCL 08H

Big Pine Creek Ditch, in Benton County, Indiana, was channelized in 1932. Subsequent changes in channel form and slope have caused considerable lateral migration, scour and fill at various points down the 7 mile channelized reach. A study of this test stream includes an assessment of the cross sectional and morphometric deterioration, as meander development and profile adjustments have considerably reduced the channel's drainage capacity. GRA

N78-14624# Wyoming Univ., Laramie. Water Resources Research Inst.
RELATIONSHIP OF TECTONIC STRUCTURE TO AQUIFER MECHANICS IN THE WESTERN GRAND CANYON DISTRICT, ARIZONA
Peter W. Huntoon Apr. 1977 91 p refs
(Contract DI-14-34-0001-6134; OWRT Proj. B-031-WYO(1))
(PB-272308/8; W77-11867; Ser-66) Avail: NTIS HC A05/MF A01 CSCL 08H

The Rampart Cave Member of the Muay Limestone, the major aquifer in the western Grand Canyon district, was studied. It was found that prospects for developing large ground water supplies in the district are dim because total recharge and permeabilities are small, and there are no extensive permeable zones under the plate in which large quantities of water are stored. Selected fault zones that supply water to large springs offer the most promising areas for drilling. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N78-14625* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MULTI-CELL BATTERY PROTECTION SYSTEM Patent
Ralph D. Thomas and William J. Nagle, inventors (to NASA) Issued 6 Dec. 1977 5 p Filed 19 May 1976 Supersedes N76-23713 (14 - 14, p 1820)
(NASA-Case-LEW-12039-1; US-Patent-4,061,955; US-Patent-Appl-SN-687822; US-Patent-Class-320-6; US-Patent-Class-320-15; US-Patent-Class-320-18; US-Patent-Class-320-40) Avail: US Patent Office CSCL 10A

A multi-cell battery protection system is described wherein each cell has its own individual protective circuit. The protective circuits consist of a solid state comparator unit and a high current switching device such as a relay. The comparator units each continuously monitor the associated cell and when the cell voltage either exceeds a predetermined high level or falls below a predetermined low level, the relay is actuated whereby a bypass circuit is completed across the cell thereby effectively removing the cell from the series of cells.
Official Gazette of the U.S. Patent Office

N78-14626+ National Center for Scientific and Technical Documentation, Brussels (Belgium).
UNCONVENTIONAL ENERGY SOURCES. A SELECT BIBLIOGRAPHY
E. H. Lapeysen, comp. Feb. 1974 64 p refs
(NCWTD-CNDST-Bib-6) Avail: NTIS HC A04

A total of 680 references to articles covering economics, statistics, and prospects; geothermal energy; prospects towards new policies; solar energy; and tidal energy and wind power are listed. There are no subject or author indexes. ESA

N78-14627+ National Center for Scientific and Technical Documentation, Brussels (Belgium).
WIND POWER SYSTEMS. A SELECT BIBLIOGRAPHY
Eduard H. Lapeysen, comp. Jan. 1977 58 p refs
(NCWTD-CNDST-Bib-7) Avail: NTIS HC A04

The list includes 331 reports, articles, conference papers, and other documents concerning wind energy policy, conversion, technology, and transfer. A subject index is included. ESA

N78-14628*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
REAL-TIME AND ACCELERATED OUTDOOR ENDURANCE TESTING OF SOLAR CELLS
Americo F. Forestieri and Evelyn Anagnostou Aug. 1977 26 p refs Presented at 1977 Photovoltaics Solar Energy Conf., Luxembourg, 27-30 Sep. 1977; sponsored by Comm. of the European Communities Sponsored in part by ERDA
(Contract E(49-26)-1022)
(NASA-TM-73743; E-9310; ERDA/NASA/1022/77/17) Avail: NTIS HC A03/MF A01 CSCL 10A

Real-time and accelerated outdoor endurance testing was performed on a variety of samples of interest to the National Photovoltaic Conversion Program. The real-time tests were performed at seven different sites and the accelerated tests were performed at one of those sites in the southwestern United States. The purpose of the tests were to help evaluate the lifetime of photovoltaic systems. Three types of samples were tested; transmission samples of possible cover materials, sub-modules constructed using these materials attached to solar cells, and solar cell modules produced by the manufacturers for the ERDA program. Results indicate that suitable cover materials are glass, FEP-A and PFA. Dirt accumulation and cleanability are important factors in the selection of solar cell module covers and encapsulants. Author

N78-14629*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
US TERRESTRIAL SOLAR CELL CALIBRATION AND MEASUREMENT PROCEDURES
Henry W. Brandhorst, Jr. Sep. 1977 16 p refs Presented at 1977 Photovoltaics Solar Energy Conf., Luxembourg, 27-30 Sep. 1977; sponsored by Comm. of the European Communities Sponsored in part by ERDA
(Contract E(49-26)-1022)
(NASA-TM-73788; E-9353; ERDA/NASA/1022/77/20) Avail: NTIS HC A02/MF A01 CSCL 10A

A workshop was held in the fall of 1976, to evaluate and revise interim terrestrial solar cell calibration and measurement procedures. The revisions made to the interim testing procedures are described. The calibration of reference cells and the design of their holders are covered. Considerations include view angle and optical and thermal matching. Atmospheric factors which affect the calibration and performance of solar cells are discussed. The most critical atmospheric parameter appears to be water vapor. Techniques for matching reference cells to cells or arrays under test are described. Data showing errors in performance under artificial sunlight simulators due to mismatch of reference and test cells are presented. Finally, measurement procedures and data transformations needed to obtain the performance of solar cells and arrays in outdoor natural sunlight are described. Author

N78-14630*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOLAR ENERGY METER
R. M. Masters Sep. 1977 12 p ref Sponsored in part by ERDA
(Contract E(49-26)-1022)
(NASA-TM-73791; E-9358; ERDA/NASA/1022/77/21) Avail: NTIS HC A02/MF A01 CSCL 10A

An instrument was developed to continually integrate the energy available in incident light on a specifically oriented surface. The unit was designed for outdoor use in remote locations and is capable of operation over a temperature range of -20 to +60 C with good accuracy. The unit is weather resistant, requires low power, has a high input impedance, is inexpensive, and has a visual readout and an analog output for recording. Author

N78-14631*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANION EXCHANGE MEMBRANES FOR ELECTROCHEMICAL OXIDATION-REDUCTION ENERGY STORAGE SYSTEM
Patricia M. ODonnell, Dean W. Sheibley, and Randall F. Gahn Aug. 1977 22 p refs
(Contract E(49-28)-1002)
(NASA-TM-73751; ERDA/NASA-1002/77/2; E-9222) Avail: NTIS HC A02/MF A01 CSCL 10C

Oxidation-reduction couples in concentrated solutions separated by appropriate ion selective membranes were considered as an attractive approach to bulk electrical energy storage. A key problem is the development of the membrane. Several promising types of anionic membranes are discussed which were developed and evaluated for redox energy storage systems. The copolymers of ethyleneglycoldimethacrylate with either 2-vinylpyridine or vinylbenzl chloride gave stable resistance values compared to the copolymer of vinylbenzlchloride and divinylbenzene which served as the baseline membrane. A polyvinylchloride film aminated with tetraethylenepentamine had a low resistance but a high ion transfer rate. A slurry coated vinylpyridine had the lowest ion transfer rate. All these membranes functioned well in laboratory cells at ambient temperatures with the acidic chloride oxidant/reductant system, Fe 3, Fe 2/Ti 3, Ti 4. Author

N78-14632*# Grumman Aerospace Corp., Bethpage, N.Y.
THERMAL ENERGY STORAGE HEAT EXCHANGER: MOLTEN SALT HEAT EXCHANGER DESIGN FOR UTILITY POWER PLANTS Final Report, Jul. 1976 - Jul. 1977
Angelo Ferarra, George Yenetchi, Robert Haslett, and Robert Kosson Oct. 1977 207 p refs
(Contract NAS3-20117)
(NASA-CR-135244) Avail: NTIS HC A10/MF A01 CSCL 10C

The use of thermal energy storage (TES) in the latent heat of molten salts as a means of conserving fossil fuels and lowering the cost of electric power was evaluated. Public utility systems provided electric power on demand. This demand is generally maximum during late weekday afternoons, with considerably lower overnight and weekend loads. Typically, the average demand is only 60% to 80% of peak load. As peak load increases, the present practice is to purchase power from other grid facilities or to bring older less efficient fossil-fuel plants on line which increase the cost of electric power. The widespread use of oil-fired boilers, gas turbine and diesel equipment to meet peaking loads depletes our oil-based energy resources. Heat exchangers utilizing molten salts can be used to level the energy consumption curve. The study begins with a demand analysis and the consideration of several existing modern fossil-fuel and nuclear power plants for use as models. Salts are evaluated for thermodynamic, economic, corrosive, and safety characteristics. Heat exchanger concepts are explored and heat exchanger designs are conceived. Finally, the economics of TES conversions in existing plants and new construction is analyzed. The study concluded that TES is feasible in electric power generation. Substantial data are presented for TES design, and reference material for further investigation of techniques is included. Author

N78-14633*# Grumman Aerospace Corp., Bethpage, N.Y.
THERMAL ENERGY STORAGE HEAT EXCHANGER: MOLTEN SALT HEAT EXCHANGER DESIGN FOR UTILITY POWER PLANTS Topical Report, Jul. 1976 - Jul. 1977
Angelo Ferarra, George Yenetchi, Robert Haslett, and Robert Kosson Oct. 1977 36 p refs
(Contract NAS3-20117)
(NASA-CR-135245) Avail: NTIS HC A03/MF A01 CSCL 10C

Sizing procedures are presented for latent heat thermal energy storage systems that can be used for electric utility off-peak energy storage, solar power plants and other preliminary design applications. Author

N78-14634# Sandia Labs., Albuquerque, N. Mex.
OPTIMUM OPERATING CONDITIONS FOR A CYLINDRICAL PARABOLIC FOCUSING COLLECTOR/RANKINE POWER GENERATION CYCLE SYSTEM
M. W. Edenburn 1977 18 p refs Presented at 12th Intersociety Energy Conversion Eng. Conf., Wash., D. C., 28 Aug. 1977
(Contract EY-C-04-0789)
(SAND-75-6132; Conf-770804-2) Avail: NTIS HC A02/MF A01

System operating temperatures, boiler pressure, and associated parameters which maximize solar to electric conversion efficiency and which minimize collector/storage/power cycle system costs were determined for an electrical generation system which uses cylindrical parabolic focusing collectors as a source of heat, a stratified liquid unit for storage, and a Rankine power generation cycle for electrical generation. To perform a parametric study of the system, the analysis used an experimentally verified solar energy collector model to predict collector energy output as a function of inlet temperature, outlet temperature and fluid flow rate; a Rankine cycle model to predict cycle efficiency and heating fluid outlet temperature as a function of peak superheat temperature and boiler pressure; and a daily cycling storage unit model. The study shows that electrical generation efficiency is maximized by using a peak superheat temperature of 635 K (683 F); but, when storage cost is considered, the minimum cost system uses a peak superheat temperature of 686 K (775 F) and a boiler pressure of 2.76 MN/sq m. ERA

N78-14635# Army Electronics Command, Fort Monmouth, N. J.
UTILIZATION OF ALUMINUM ALLOY ANODES FOR AN ELECTROCHEMICAL HEATER
S. Gilman and P. Bramhall Sep. 1977 36 p refs
(DA Proj. 1L7-62724-AH-99)
(AD-A046116; ECOM-4533) Avail: NTIS HC A03/MF A01 CSCL 09/1

A magnesium/manganese dioxide cell has been developed for direct heating of field rations under short-circuit conditions. Although fast and convenient, the cell has the disadvantage of producing considerable hydrogen gas during its operation, thereby presenting a potential explosion hazard. This report deals with an electrochemical analysis of the hydrogen evolution problem in the magnesium/manganese dioxide heater cell and with the exploration of aluminum alloys as low-gassing substitutes for magnesium in such a cell. The results reveal that, in the early period of discharge of a magnesium cell, most of the hydrogen is produced at the anode. Gas production becomes more significant at the cathode during the latter period of cell discharge. The use of an aluminum alloy anode of a particular composition

greatly reduces the problem of gassing at the anode and completely eliminated gassing at the cathode. Author (GRA)

N78-14636# Solarex Corp., Rockville, Md.
NONREFLECTING VERTICAL JUNCTION SILICON SOLAR CELL OPTIMIZATION Interim Report, May 1976 - May 1977
John Wohlgemuth, J. Lindmayer, and A. Scheinine Jul. 1977 83 p refs
(Contract F33615-76-C-2058; AF Proj. 3145)
(AD-A046150; AFAPL-TR-77-38) Avail: NTIS HC A05/MF A01 CSCL 10/2

This work on nonreflective vertical-junction silicon solar cells has resulted in high conversion efficiency radiation resistant solar cells. New techniques of oxidation growth and the use of photolothography enable the use of an orientation dependent etch to produce grooves 5-10 microns wide and over 100 microns deep. These silicon wafers have been processed into solar cells with all of the processes performed at temperatures compatible with producing high efficiency solar cells. A theoretical calculation of the generated current for the vertical junction structure was performed. It indicates the decreased dependence on carrier diffusion length and, therefore, the reduced effect of radiation damage on collection efficiency for vertical junction solar cells. Vertical junction solar cells 2 cm x 2 cm in size have been fabricated with AMO conversion efficiencies greater than 13%. These cells have shown superior radiation resistance.
Author (GRA)

N78-14637# Pennsylvania Univ., Philadelphia. Dept. of Chemical and Biochemical Engineering.
LITHIUM SULFURYL CHLORIDE BATTERY Final Report, 1 Dec. 1974 - 30 Nov. 1975
Leonard Nanis, Vijay K. Kapur, and Mehmet Ali Gencer Apr. 1977 21 p
(Contract DAAB07-75-C-1676; DA Proj. 1S7-62705-AH-94)
(AD-A045953; ECOM-75-1676-F) Avail: NTIS HC A02/MF A01 CSCL 10/3

The conductance of a battery electrolyte should be large to avoid internal resistive losses during current passage. Since the maximum current which may be drawn from a cell is resistance limited, the conductivity of an electrolyte becomes an important parameter for optimum cell design. As is well known, the concentration of an electrolyte in several types of aqueous batteries is chosen primarily for maximum conductivity. Accordingly, work on this project was directed towards obtaining conductivity data for a practical range of concentrations of LiAlCl4 (0.1-1.OM) dissolved in SO2Cl2. In order to obtain data rapidly, a novel procedure was devised which yielded good results with relatively simple equipment. A four-point dipping conductivity probe was developed to supplement the two-point method (described in ECOM75-1676-1) which included a large frequency effect associated with the low dielectric constant of SO2Cl2. GRA

N78-14638# EIC, Inc., Newton, Mass.
LITHIUM-INORGANIC ELECTROLYTE BATTERIES Quarterly Report, 1 Apr. - 30 Jun. 1977
Joseph R. Driscoll, Peter G. Gudrais, and S. Barry Brummer Oct. 1977 46 p refs
(Contract DAAB07-74-C-0030; DA Proj. 1T1-61102-A-34A)
(AD-A046161; C-401-14; ECOM-74-0030-14; QR-14) Avail: NTIS HC A03/MF A01 CSCL 10/3

The major area of investigation during this report period has been the voltage delay and depression in Li/SOCl2 cells after storage at 71 C. These are due to films on the Li anode surface which arise from reaction with the electrolyte. The effects of test-cell design have been assessed: Substitution of Teflon by quartz has a major effect in improving cell performance; cells with a small surface-to-volume ratio show better performance than those with large surface-to-volume ratios; presence of exposed Ni Exmet causes an increase in cell passivation, which is most noticeable with small area electrodes. This effect diminishes with larger area electrodes. This increased passivation is most likely due to increased Li corrosion caused by the reduction of SOCl2 on the exposed Exmet. GRA

N78-14639# Oak Ridge National Lab., Tenn.
MOLTEN CARBONATE FUEL CELL RESEARCH AT ORNL
J. Braunstein, H. R. Bronstein, S. Cantor, D. Heatherly, and C. E. Vallet May 1977 25 p refs
(Contract W-7405-eng-26)
(ORNL/TM-5886) Avail: NTIS HC A02/MF A01

The activities described include a literature survey on molten carbonates, design, acquisition and installation of apparatus for experimental studies of molten carbonates, initial experiments on materials compatibility with molten carbonates, electrolysis experiments for the determination of transference numbers, and theoretical studies of transport behavior and the coupling of mass flows in molten carbonate mixtures. Significant accomplishments were the theoretical prediction of a possibly appreciable change in the alkali ion ratio at molten carbonate fuel cell electrodes, operated at high current densities, as a result of mobility differences of the alkali ions; design, construction and assembly of an electrolysis cell, and initiation of measurements of composition profiles in mixed alkali carbonate electrolytes; initiation of differential scanning calorimetry of pure alkali carbonates for quantitative measurement of transition enthalpies, eventually leading to new, more reliable values of the enthalpies and free energies of formation of the pure and mixed carbonates. ERA

N78-14640# Argonne National Lab., Ill.
APPLIANCE SAFETY BY DESIGN
1977 33 p refs Presented at IEEE Appliance Tech. Conf., Pittsburgh, Pa., 10 May 1977
(Contract W-31-109-eng-38)
(CONF-770529-1) Avail: NTIS HC A03/MF A01

Reputable manufacturers' concern with the safety of those who come in contact with their products was reviewed. It is shown that product safety, carefully considered during each design process stage contributes greatly to the acceptance of products and the satisfaction of customers. Product safety is identified as an integral part of product design and must be considered as each element of the design is established. Some of the techniques used by manfacturers to develop a safe and a reliable product are discussed. ERA

N78-14641# Energy Research and Development Administration, Washington, D. C. Div. of Conservation Research and Technology.
MODELING AND ANALYSIS OF INDUSTRIAL ENERGY USAGE Workshop Summary Report 21-23 Jun. 1976
1976 123 p refs
(Contract EX-76-C-10-3835)
(MTR-7329) Avail: NTIS HC A06/MF A01

A program plan for promoting the use and dissemination of advanced modeling techniques to achieve energy conservation was developed. Seven working sessions were conducted concurrently to draft specific recommendations for government, industry, and university participation in selected aspects of the program. Conclusions and recommendations developed in each working session are presented. ERA

N78-14642# Sandia Labs., Albuquerque, N. Mex.
SOLAR IRRIGATION PROGRAM PLAN, REVISION
Robert L. Alvis and S. G. Vandevender Jun. 1977 33 p refs
(Contract EY-76-C-04-0789)
(SAND-77-0730-Rev) Avail: NTIS HC A03/MF A01

The Energy Research and Development Administration (ERDA) solar irrigation program is described. The updated goals of the plan are listed, the participants named, and their responsibilities outlined. ERDA has the program responsibility, and ERDA field offices the contractural responsibility. Three solar irrigation experiments planned, system analyses to be conducted, and the participants of the program are discribed. This document is intended to be used as a program guide for accomplishing the program goals. ERA

N78-14643# Energy Research and Development Administration, Washington, D. C. Div. of Solar Energy.
PROGRAM RESEARCH AND DEVELOPMENT ANNOUNCEMENT (PRDA). SOLAR COLLECTOR MATERIALS AND FLUIDS FOR SOLAR HEATING AND COOLING APPLICATIONS
10 May 1977 53 p
(PRDA-EG-77-D-29-0003) Avail: NTIS HC A04/MF A01

Research proposals are solicited in the following areas: (1) development of superior liquid coolants; (2) development of corrosion inhibitors for aqueous coolants; (3) development of freeze protection methods; (4) nonglass glazings and surface coating; (5) solar anti-reflective coatings and etching and infrared reflective coatings for glass; (6) glazing breakage; (7) development of selective surfaces; (8) low cost innovative absorbers; (9) development of improved sealants; (10) development of improved breathing control techniques; and (11) development of improved insulation materials. ERA

N78-14644# Battelle Pacific Northwest Labs., Richland, Wash.
GEOCITY: A COMPUTER CODE FOR CALCULATING COSTS OF DISTRICT HEATING USING GEOTHERMAL RESOURCES
C. L. McDonald, C. H. Bloomster, and S. C. Schulte Feb. 1977 80 p refs
(Contract EY-76-C-06-1830)
(BNWL-2208) Avail: NTIS HC A05/MF A01

A computer simulation model (GEOCITY) developed to study the economics of district heating using geothermal energy is described. The cost of district heating based on climate, population, resource characteristics, and financing conditions is calculated. The principal input variables are minimum temperature, heating degree days, population size and density, resource temperature and distance from load center, and the interest rate. From this input data the model designs the transmission and district heating systems. From this design, GEOCITY calculates the capital and operating costs for the entire system, including the production and disposal of the geothermal water. The distribution system model calculates the cost of heat by simulating the design and the operation of the district heating system. The reservoir model calculates the cost of energy by simulating the discovery, development, and operation of a geothermal resource and the transmission of this energy to a distribution center. ERA

N78-14645# General Electric Co., Philadelphia, Pa. Space Div.
WIND ENERGY MISSION ANALYSIS, EXECUTIVE SUMMARY
18 Feb. 1977 28 p
(Contract EY-76-C-02-2578)
(COO-2578-1-1) Avail: NTIS HC A03/MF A01

High-potential applications, functional, performance, operational, and cost goals for wind energy conversion systems and the impact of the wide-scale deployment of such systems on energy users were evaluated. The institutional and nontechnical problems associated with the acceptance of wind energy were also studied. Emphasis was placed on identifying and exploring high-aggregate energy users who have significant potential to utilize wind energy in place of other alternatives. ERA

N78-14646# General Electric Co., Philadelphia, Pa. Space Div.
WIND ENERGY MISSION ANALYSIS Final Report
18 Feb. 1977 252 p refs
(Contract EY-76-C-02-2578)
(COO-2578-1-2) Avail: NTIS HC A12/MF A01

The development of wind energy systems in the U.S. is discussed under the following headings: baseline power systems, assessment of wind potential, identification of high potential applications, electric utilities, residential application, paper industry application, agriculture application, and remote community applications. ERA

N78-14647# General Electric Co., Philadelphia, Pa. Space Div.
WIND ENERGY MISSION ANALYSIS, APPENDICES A-J Final Report
18 Feb. 1977 504 p
(Contract EY-76-C-02-2578)
(COO-2578-1-3) Avail: NTIS HC A22/MF A01

Information is presented concerning meteorological data and supporting analyses, gross energy consumption patterns and end-use analysis, as well as analysis for industrial applications of wind energy conversion systems (WECS). Also presented is an analysis for residential applications of WECS, an analysis for application of WECS to communities remote from utility grids, an analysis for agricultural applications of WECS, a regional evaluation of the economics of wind turbine generation to the U. S. electric utility district, impact of storage on WECS, financial analysis techniques, and system spacing. ERA

N78-14648# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
OPTIMIZATION OF COATINGS FOR FLAT PLATE SOLAR COLLECTORS, PHASE 2 Progress Report, 28 Jun. - 31 Dec. 1976
R. J. H. Lin Jan. 1977 78 p refs
(Contract EY-76-C-02-2930)
(COO-2930-4) Avail: NTIS HC A05/MF A01

Optical coatings that would enhance the economic feasibility of flat plate solar collectors were studied. Etched and dipcoated antireflection coatings and selective absorbing plated and paint coatings that are low cost, and optically efficient coatings were investigated. A selective paint coating, applied by dip coating, was developed with solar absorptance of 0.92 and room temperature emittance of 0.13. The coating cost was estimated at less than 5 cents/sq ft, a factor of at least 10 lower than the selective plated coatings investigated. Black chrome was shown to endure at least 30 days in an accelerated humidity test with no degradation. The black chrome coating life was estimated to be greater than 20 years. ERA

N78-14649# Virginia Univ., Charlottesville. Dept. of Mechanical Engineering.
ANNUAL COLLECTION AND STORAGE OF SOLAR ENERGY FOR THE HEATING OF BUILDINGS Progress Report, May - Nov. 1976
J. Taylor Beard, J. W. Dickey, F. A. Iachetta, and L. U. Lilleleht Jan. 1977 32 p
(Contract EY-76-S-05-5136)
(ORO-5136-76/1; Rept-1) Avail: NTIS HC A03/MF A01

The system is composed of an energy storage sub-system which stores hot water in an underground pool and of a solar collector sub-system which acts not only to collect solar energy throughout the year but also to limit the evaporative and convective heat losses from the storage system. A storage sub-system was constructed using the initial design specifications. A structural failure of that storage pool occurred in August resulting from a leak in the pool liner which caused a failure of the pool structure. A revised design of the storage pool sub-system was implemented and construction was completed. The collector sub-system was designed and constructed. ERA

N78-14650# JBF Scientific Corp., Washington, D. C.
SUMMARY OF CURRENT COST ESTIMATES OF LARGE WIND ENERGY SYSTEMS
Feb. 1977 64 p
(Contract EX-76-C-01-2521)
(DSE/2521-1) Avail: NTIS HC A04/MF A01

The Federal Wind Energy Program, over the past two years has substantially extended the state of knowledge about the costs and performance of large Wind Energy Conversion Systems (WECS). Much of this progress was achieved as a result of a series of ERDA sponsored studies dealing with the system design, mission analysis, and regional applicability of WECS. This report reviews these studies, summarizes the most pertinent results, and provides a view of the current status and uncertainties surrounding the economics of generating energy from the wind for electric utility applications. ERA

N78-14651# Brookhaven National Lab., Upton, N. Y. Dept. of Applied Science.
PROSPECTS FOR THE UTILIZATION OF WASTE HEAT IN LARGE SCALE DISTRICT HEATING SYSTEMS
J. Karkheck and J. Powell 1977 27 p refs Presented at Conf. on Waste Heat Management and Util., Miami Beach, Fla., 9 May 1977
(BNL-22559; Conf-770516-2) Avail: NTIS HC A03/MF A01

Analyses of model district heating systems for nine U.S. urban areas, including projected heat costs, are presented. In addition, projections of nationwide levels of implementation of district heating systems are discussed. Results show that about half of the current population could be served through district

heating at heat cost levels equal to the effective heat cost of imported oil. ERA

N78-14652# General Atomic Co., San Diego, Calif.
LARGE CLOSED-CYCLE GAS TURBINE PLANT
C. F. McDonald 1977 265 p refs Presented at AGARD lecture series on closed-cycle gas turbines, Brussels, Belgium, 9 May 1977
(Contract EY-76-C-03-0167-046)
(GA-A-14311; Conf-770540-1) Avail: NTIS HC A12/MF A01

An application of the closed-cycle gas turbine for electrical power generation is a plant with a high temperature gas cooled reactor (HTGR) as the heat source, and this paper presents the design studies for a 1200 MW(e) plant. The GT-HTGR plant combines the existing HTGR core with a closed-cycle helium gas turbine power conversion system which operates on the same helium used as the reactor coolant. In this series of lectures a summary is given of the design evolution for a large nuclear closed-cycle gas turbine power plant study for U.S. utility central stations. The presentation includes a background on closed-cycle gas turbines, the incentives for the GT-HTGR, cycle selection, plant configuration studies, performance, selection of a reference plant design, component design activities, and a description of the waste heat binary power plant. Included also are development and testing alternatives, and related international programs in the closed-cycle gas turbine field. ERA

N78-14653# Los Alamos Scientific Lab., N. Mex.
HEAT PIPE REACTORS FOR SPACE POWER APPLICATIONS
D. R. Koenig, W. A. Ranken, and E. W. Salmi 1977 9 p Presented at AIAA meeting, St. Louis, Missouri, 3 Mar. 1977
(Contract W-7405-eng-36)
(LA-UR-77-296; Conf-770302-2) Avail: NTIS HC A02/MF A01

A family of heat pipe reactors design concepts has been developed to provide heat to a variety of electrical conversion systems. Three power plants are described that span the power range 1-500 kW(e) and operate in the temperature range 1200 to 1700 K. The reactors are fast, compact, heat-pipe cooled, high-temperature nuclear reactors fueled with fully enriched refractory fuels, UC-ZrC or UO2. Each fuel element is cooled by an axially located molybdenum heat pipe containing either sodium or lithium vapor. ERA

N78-14654# RCA Advanced Technology Labs., Camden, N. J.
SOLAR DRIVEN AIR CONDITIONING SYSTEM Semiannual Status Report
B. Shelpuk and M. Crouthamel Jan. 1977 34 p
(Contract EY-76-C-02-2938)
(COO/2938-77/1; ATL-CR-77-01) Avail: NTIS HC A03/MF A01

The feasibility of building a solar driven air conditioner on the basis of the Vuilleumier thermodynamic cycle was studied. The technology used was applied initially in an aerospace requirement for a reliable, long lived cryogenic refrigerator for an infrared detection system. The extension of this technology to an air conditioning application was explored but found unsuitable because the low temperature heat source, gas flow friction through the machine, and void volume effects interacted in subtle ways to degrade performance. Various combinations of design variables which affect performance required simulation on a computer. New materials and structures were required to replace the standard cryogenic components which were deficient when used in the air conditioning application. The feasibility for cooling based on the VM thermodynamic cycle was analytically shown to be on a sound thermodynamic basis. ERA

N78-14655# Delaware Univ., Newark.
CONSUMER DEMAND ANALYSIS: SOLAR HEATING AND COOLING OF BUILDINGS Final Report
Jerome E. Scott Sep. 1976 238 p refs
(Contract EY-76-C-02-2598)
(COO-2598-1) Avail: NTIS HC A11/MF A01

The acceptability of solar heating and cooling to homebuyers was investigated. The study assesses the extent of homeowner awareness of solar technologies, estimates the acceptability of elevated first costs including willingness to trade higher initial costs for life cycle savings, and investigates the impact of solar aesthetics. Also explored are areas of potential concern to homeowners in evaluating a solar alternative. The socioeconomic and attitudinal characteristics of individuals more likely to purchase a solar home rather than a conventional home were studied. The results are based on group depth interviews and personal interviews with active homeseekers, top executives of large residential development firms, and architects. The sample was split evenly between Denver, Colorado and the Philadelphia, Pa./Wilmington, Del. areas. Implications of the results for the commercialization of solar energy and possible public policy decisions are discussed. ERA

N78-14656# Battelle Columbus Labs., Ohio.
SURVEY OF THE APPLICATIONS OF SOLAR THERMAL ENERGY SYSTEMS TO INDUSTRIAL PROCESS HEAT. VOLUME 1: SUMMARY Final Report
Jan. 1977 88 p refs Prepared in cooperation with Honeywell, Inc., Minneapolis
(Contract W-7405-eng-92)
(TID-27348/1-Vol-1) Avail: NTIS HC A05/MF A01

Process heat requirements of 20 industries were identified and characterized according to quantity, temperature range, and form. Concepts for solar thermal energy systems were evaluated with respect to expected performance and cost in industrial applications. A preliminary assessment was made of related nontechnical issues, i.e., economic, institutional, legal, and environmental. A summary is included of the methodology and results of the entire project. ERA

N78-14657# Iowa State Univ. of Science and Technology, Ames. Engineering Research Inst.
ENHANCED SINGLE-PHASE HEAT TRANSFER FOR OCEAN THERMAL ENERGY CONVERSION SYSTEMS Final Report
A. E. Bergles and M. K. Jensen Apr. 1977 113 p refs
(Contract W-7405-eng-26)
(ORNL/Sub-77/14216/1; HTL-13; ISU-ERI-AMES-77314)
Avail: NTIS HC A06/MF A01

The utilization of enhanced heat transfer surfaces for both the boiler and condenser was investigated in order to reduce the size and cost of OTEC systems. It was found that single phase, forced convection heat transfer can be enhanced by a wide variety of techniques which do not require external power to generate and sustain. These techniques are: rough surfaces, extended surfaces, displaced enhancement devices, and swirl flow devices. The world literature was surveyed to locate representative data for those techniques. A computer search for an extensive collection of general literature on heat transfer enhancement was utilized. Heat transfer and friction factor data are presented for various techniques and subgroups of techniques, particularly those data which demonstrate the maximum reported improvements in heat transfer coefficients. ERA

N78-14658# Institute of Gas Technology, Chicago, Ill.
ALTERNATIVE ENERGY TRANSMISSION SYSTEMS FROM OTEC PLANTS, PROJECT 8980 Quarterly Progress Report, Oct. - Dec. 1976
A. Talib, B. Yudow, C. Blazek, S. Foh, A. Konopka, and N. Biederman Feb. 1977 90 p refs
(Contract EX-76-C-01-2426)
(DSE/2426-8; QPR-2) Avail: NTIS HC A05/MF A01

Energy carriers necessary in transporting energy from OTEC plants to the energy user were investigated. A study of both chemical and electrical energy carriers provided a technical and economic evaluation of concepts for converting OTEC energy to a storable, transportable form and shipping it to a shore based receiving terminal. The first concept deals with an onboard electrical system used to produce high temperature heat and shipping this thermal energy to shore in some form of thermal storage system. The second concept is to use OTEC energy to produce carbonaceous fuels using electrolytic hydrogen produced onboard and carbon dioxide extracted from a sea water or delivered from shore based facility. ERA

N78-14659# Aluminum Co. of America, Alcoa Center, Pa.
CONCURRENT STUDIES OF ENHANCED HEAT TRANSFER AND MATERIALS FOR OCEAN THERMAL EXCHANGERS Progress Report

R. A. Bonewitz 29 Oct. 1976 75 p refs
(Contract EY-76-S-02-2641)
(COO-2641-1a) Avail: NTIS HC A04/MF A01

Aluminum alloys 1100, 3003, 5052, and 6063 were examined for their compatibility with the proposed working fluids for ocean thermal energy conversion, anhydrous ammonia, Freon 22 and propane, and mixtures of these with sea water. Such mixtures would occur if leaks develop in evaporator or condenser heat exchangers. These aluminum alloys are compatible with the anhydrous working fluids. In ammonia sea water solutions only limited general corrosion is found in 0 to 30 percent ammonia, no corrosion in 30 to 90 percent ammonia, and 'self limiting' pits in 90 to 100 percent ammonia so rapid deterioration of the exchangers would not occur. No corrosion was observed in sea water saturated with Freon 22 or propane. No differences in alloy performance were evident in any of these tests so selection can be made on the basis of compatibility with sea water. A review of the available literature indicated that 5052 shows the best performance in surface sea water followed by 1100, 3003 and then 6063 alloy. ERA

N78-14660# Oak Ridge National Lab., Tenn.
OUTLINE FOR OPTIMIZING AND EVALUATING PROPOSED OTEC SYSTEMS
R. N. Lyon 1977 16 p Presented at 4th Ocean Thermal Energy Conversion Conf. New Orleans, 22 Mar. 1977
(Contract W-7405-eng-26)
(CONF-770331-2) Avail: NTIS HC A02/MF A01

The need to begin the development of a general modeling and optimization method for ocean thermal energy conversion systems for assistance in making a wide variety of administrative and design decisions is emphasized. Concepts that should be included in the model are outlined. ERA

N78-14661# Oak Ridge National Lab., Tenn.
ANALYTICAL AND EXPERIMENTAL STUDIES OF OTEC HEAT TRANSFER PROBLEMS AT OAK RIDGE NATIONAL LABORATORY
1977 27 p refs Presented at 4th Ocean Thermal Energy Conversion Conf., New Orleans, 22 Mar. 1977
(Contract W-7405-eng-26)
(CONF-770331-1) Avail: NTIS HC A03/MF A01

The analysis, planning, and implementation of a program to develop advanced heat exchangers for ocean thermal energy conversion (OTEC) are described. An analysis of the NH3 binary cycle and the current state of commercial heat exchanger technology indicated that the goals of this program should be to improve the sea water heat transfer coefficients by a factor of 2, the ammonia heat transfer coefficients by a factor of 2 to 4, and to be able to control fouling factors at a value of 0.0003 or below. These improvements coupled with qualifying aluminum for this seawater/ammonia service would go far toward assuring the economic viability of the OTEC concept. A single tube ammonia heat transfer loop has been built and operated to evaluate the heat transfer characteristics of fluted tubes. Preliminary ammonia condensation results are presented. ERA

N78-14662# Battelle Pacific Northwest Labs., Richland, Wash.
OCEAN THERMAL ENERGY CONVERSION SYSTEM BIOFOULING AND CORROSION PROBLEMS
L. D. Perrigo and G. A. Jensen Sep. 1976 31 p refs Presented at Western Region Conf., San Diego, 27 Sep. 1976
(Contract EY-76-C-01-1830)
(BNWL-SA-5970; Conf-7609135-1) Avail: NTIS HC A03/MF A01

The Energy Research and Development Administration (ERDA) is sponsoring a program to explore the possibilities for beneficially using the temperature difference between warm surface water of the tropical oceans and the deeper colder water to operate a heat engine. As much as 4 to 6% of the expected demand for power in the United States by 2020 could be supplied by this source. One of the major technical hurdles that must be overcome is the solution to biofouling problems that are expected to impede efficient heat transfer in the power plant evaporator and condenser systems. There are allied problems in the corrosion of materials that must also solved. The results of work to develop a biofouling device and the corrosion behavior of aluminum in ammonia-sea water mixtures are reported. ERA

N78-14663# Naval Postgraduate School, Monterey, Calif.
NATURE OF PRIMARY ORGANIC FILMS IN THE MARINE ENVIRONMENT AND THEIR SIGNIFICANCE FOR OCEAN THERMAL ENERGY CONVERSION (OTEC) HEAT EXCHANGE SURFACES
E. C. Haderlie Feb. 1977 42 p refs
(Contract EY-76-C-01-2515)
(BNWL-2283) Avail: NTIS HC A03/MF A01

The development of bacterial slime films on the heat exchanger surfaces of OTEC power plants is likely to be of critical importance in determining if OTEC closed cycles systems are technically and economically viable. The present state of knowledge is surveyed requiring the nature and behavior of primary films in the marine environment. Areas where further research is needed are indicated. ERA

N78-14664# Sandia Labs., Albuquerque, N. Mex.
PARAMETER STUDY FOR A CENTRAL-RECEIVER POWER STATION
F. Biggs and C. N. Vittitoe 1977 15 p refs Presented at U.S.-USSR Workshop on Solar Energy Appl., Moscow (USSR), 20 Jun. 1977
(Contract EY-76-C-04-0789)
(SAND-77-0667C; Conf-770630-1) Avail: NTIS HC A02/MF A01

The interaction between alignment and focusing strategies and heliostat errors are described and illustrated. Some descriptions of astigmatic aberrations are developed and are used to suggest an evaluation criterion for concentrators. Finally, an analysis of measurements for evaluation heliostat reflectors is given. ERA

N78-14665# Sandia Labs., Albuquerque, N. Mex.
HELIOS: A COMPUTATIONAL MODEL FOR SOLAR CONCENTRATORS
F. Biggs and C. N. Vittitoe 1977 17 p refs Presented at U.S.-USSR Workshop on Solar Energy Appl., Moscow, 20 Jun. 1977
(Contract EY-76-C-02-0789)
(SAND-77-0642C; Conf-770630-2) Avail: NTIS HC A02/MF A01

HELIOS is a computer code for mathematically simulating the behavior of the flux pattern from the concentrator field for a solar central receiver power station. Statistical methods are used to incorporate nondeterministic factors. The code is described, and some examples of its output are given. ERA

N78-14666# Southern California Edison Co., Rosebud.
INTEGRATION OF SOLAR THERMAL POWER PLANTS INTO ELECTRIC UTILITY SYSTEMS
G. W. Braun, ed. and J. W. Ballance, ed. Sep. 1976 23 p
(Contract EY-76-C-03-1117)
(TID-27627/1) Avail: NTIS HC A02/MF A01

The findings of a study designed to fill the need for an electric utility to evaluate solar thermal power plants are summarized. Calculations are described which were used to compute the economic value of solar power plants to an electric utility under assumptions that are valid today. Topics covered are: reliability evaluation, economic evaluation, storage, system operation, and cost and design considerations. ERA

N78-14667# Southern California Edison Co., Rosebud.
INTEGRATION OF SOLAR THERMAL POWER PLANTS INTO ELECTRIC UTILITY SYSTEMS
Sep. 1976 135 p refs
(Contract EY-76-C-03-1117)
(TID-27627/2) Avail: NTIS HC A07/MF A01

The operation of solar power plants as a part of a large electric utility system was studied using the Southern California Edison Company loss of load probability and production cost simulation computer programs. Solar generation was evaluated in the context of an electric system having high percentages of baseload type generation, represented by nuclear. A solar generation model was developed which included effects of hourly solar input variations, cloud induced forced outages, use of energy storage, and peak shaving dispatch. The contribution of solar generation to the system's ability to serve forecast loads was determined for varying amounts of installed solar capacity and

for varying thermal energy storage capabilities associated with the solar units. Breakeven costs for solar generation were calculated based on financial assumptions consistent with those Edison presently uses in generation resource planning. ERA

N78-14668# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
INVESTIGATION OF DIFFUSER-AUGMENTED WIND TURBINES. PART 1: EXECUTIVE SUMMARY Final Report
R. A. Oman, K. M. Foreman, and B. L. Gilbert Jan. 1977 21 p
(Contract EY-76-C-02-2616)
(COO-2616-2-Pt-1) Avail: NTIS HC A02/MF A01

The Diffuser Augmented Wind Turbine (DAWT) is one of the advanced concepts being investigated to improve the economics of wind energy conversion. The project is aimed at increasing the output and reducing the cost, the off-duty time, and the technical risk of wind energy conversion systems. The DAWT appears to be best suited to large systems for commercial power production because it permits a significant increase in the unit power output without extending the size of rotating machinery into the range where rotor dynamics cause excessive costs. ERA

N78-14669# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
INVESTIGATION OF DIFFUSER-AUGMENTED WIND TURBINES. PART 2: TECHNICAL REPORT Final Report
R. A. Oman, K. M. Foreman, and B. L. Gilbert Jan. 1977 105 p refs
(Contract EY-76-C-02-2616)
(COO-2616-2-Pt-2) Avail: NTIS HC A06/MF A01

Information on diffuser-augmented wind turbines is presented concerning the development of efficient and compact diffusers, economic analysis, and the analytical demonstration of two-stage constant speed rotor concepts. ERA

N78-14670# Sandia Labs., Albuquerque, N. Mex. Systems Analysis Dept.
APPROACH FOR EVALUATING ALTERNATIVE FUTURE ENERGY SYSTEMS: A DYNAMIC NET ENERGY ANALYSIS
J. L. Mitchiner, V. L. Dugan, and S. G. Varnado May 1977 34 p refs
(Contract EY-76-C-04-0789)
(SAND-77-0489) Avail: NTIS HC A03/MF A01

Realistic analysis of future energy systems is a difficult, but crucial, component of assuring future energy supplies. The procedure proposed is a dynamic, net energy assessment that is a resource-based method for evaluating future energy systems. The model is system, site, and application specific and is equally applicable to general system characterizations and specific designs. The implications of possible resource and societal constraints on energy development are investigated. ERA

N78-14671# Oak Ridge National Lab., Tenn.
MIGRATIONAL POLARIZATION IN HIGH-CURRENT DENSITY MOLTEN SALT ELECTROCHEMICAL DEVICES
J. Braunstein and C. E. Vallet 1977 16 p refs Presented at Meeting of the Electrochemical Soc., Philadelphia, 8 May 1977
(Contract W-7405-eng-26)
(CONF-770531-6) Avail: NTIS HC A02/MF A01

Electrochemical flux equations based on the thermodynamics of irreversible processes were derived in terms of experimental transport coefficients for binary molten salt mixtures analogous to those proposed for high temperature batteries and fuel cells. The equations and some numerical solutions indicate steady state composition gradients of significant magnitude. The effects of migrational separation must be considered along with other melt properties in the characterization of electrode behavior, melt composition, operating temperatures and differences of phase stability, wettability and other physicochemical properties at positive and negative electrodes of high current density devices with mixed electrolytes. ERA

N78-14672# Oak Ridge National Lab., Tenn.
POWER CONVERSION SYSTEM OF THE 21ST CENTURY
A. P. Fraas and G. Samuels 1977 25 p refs Presented at Amer. Soc. of Civil Eng. Spring Convention, Dallas, Texas, 25 Apr. 1977
(Contract W-7405-eng-26)
(CONF-770448-1) Avail: NTIS HC A02/MF A01

Exhaustion of our fossil-fuel reserves coupled with cost considerations will overcome emotional objections and lead to the use of nuclear fission and/or fusion as our prime energy source. In speculating on the power conversion systems best suited to use with fission or fusion reactors, a good case can be made for the thesis that these will employ a potassium or cesium vapor cycle operating with a turbine inlet temperature of 1400 to 2000 F (760 to 1100 C) that will reject its heat at around 1000 F (540 C) to a conventional steam system. The latter in turn will reject its heat at around 300 F (150 C) for use in industrial processes and district heating systems. Railroads will be electrified and automobiles and trucks will run on high energy storage batteries. Excess waste heat can be employed to distill sewage to provide fresh water, and to evaporate sewage sludge to dryness to sterilize it and yield good fertilizer. ERA

N78-14673# General Electric Co., Schenectady, N. Y. Corporate Research and Development Div.
COOL STORAGE ASSESSMENT STUDY Final Report
May 1977 153 p refs
(EPRI Proj. 76-650)
(EPRI-EM-468) Avail: NTIS HC A08/MF A01

The state of technology was assessed for reduction of air conditioning electrical loads at time of utility peak loads by using cool storage, in residential and small commercial installations. A literature survey and assessment of cool storage materials and devices were carried out. It was concluded that an ideal cool storage material should possess a small volume change at phase change, and a freezing temperature near 45 F. No such material was found. An assessment of system performance factors was carried out based on a series of system computer simulations. The systems study compared four air conditioning systems with a baseline conventional central air conditioner using a 1500 sq. ft. house. The systems included sensible and latent heat storage media in cycles utilizing one and two heat pumps. ERA

N78-14674# Electric Power Research Inst., Palo Alto, Calif.
COAL AND NUCLEAR GENERATING COSTS
C. L. Rudasill Apr. 1977 38 p
(EPRI-PS-455-SR) Avail: NTIS HC A03/MF A01

Costs of producing electricity from coal and nuclear power stations, using currently available technology, analyzed based on the results of contracted studies made by several consulting organizations. The analysis was made on a regional basis to consider differences in coal characteristics, transportation differences, and labor and local material costs in various parts of the country. The major factors that affect coal and nuclear generation costs were investigated on a consistent basis. The overall results of the study indicate that: (1) both coal and nuclear generation can be economically attractive in all regions; (2) nuclear generation shows an average economic advantage in all regions, particularly in the east, where higher delivered coal prices prevail; and (3) any new base-load generating technology must achieve levelized busbar costs of 35 to 45 mills per kilowatt hour to compete with existing technology on an economic basis. ERA

N78-14675# Brookhaven National Lab., Upton, N. Y.
REGIONAL REFERENCE ENERGY SYSTEMS
A. L. Hermelee Jun. 1977 464 p refs
(Contract EY-76-C-02-0016)
(EPRI-EA-462) Avail: NTIS HC A20/MF A01

A regional energy systems formulation incorporating an integrative view of the energy system such that all resources, technologies, and uses of energy are set forth in a uniform manner is presented here. This approach, based on the Reference Energy System (RES), is broadly applicable to the assessment of energy technologies and policies at a regional level. Reference energy systems have been developed for each of the nine census regions and summaries of the regional data for the entire United States are given. RES's were formulated for the base year 1972, and projections were developed for 1980, 1985, and 2000.ERA

N78-14676# Brookhaven National Lab., Upton, N. Y. Dept. of Applied Science.
ELECTROCHEMICAL CHARACTERISTICS OF Zr O2-Y2 O3 SOLID ELECTROLYTES FOR FUEL CELLS
H. S. Issacs, P. G. Russell, and L. J. Olmer 1977 11 p refs Presented at the Meeting of the Electrochem. Soc., Philadelphia, 8 May 1977
(Contract EY-76-C-02-0016)
(BNL-22881; Conf-770531-9) Avail: NTIS HC A02/MF A01

A wide range of techniques, now available for the study of electrochemical characteristics of solid oxide fuel cells, were developed for investigating aqueous electrochemical systems. In particular a-c methods can be used for determining the types and kinetic parameters of processes which control the rates of reaction. An investigation of the temperature and potential behavior of electrodes, electrolytes and cells constructed from platinum coated ZrO2-Y2O3 electrolytes is reported. ERA

N78-14677# Argonne National Lab., Ill.
EFFECTS OF METAL ADDITIVES ON THE PERFORMANCE CHARACTERISTICS OF LITHIUM-ALUMINUM ALLOY ELECTRODES
D. R. Vissers, K. E. Anderson, and F. C. Mrazek 1977 12 p refs Presented at Meeting of the Electrochemical Soc., Philadelphia, Pa., 8 May 1977
(Contract W-31-109-eng-38)
(CONF-770531-4) Avail: NTIS HC A02/MF A01

In an effort to improve the performance of the lithium-aluminum alloy electrode investigations were conducted to determine the effect of various metal additives (tin, lead, copper, and indium) on the performance and cycle life (capacity retention) of these alloys. The electrodes were characterized by the measuring of the achievable capacity densities as a function of current density and number of cycle. The addition of 5 wt percent copper, 5 wt percent tin, or 10 wt percent lead did not markedly improve the cycle life of the lithium-metal alloy electrode; however, the tin addition improved the performance of the electrode during its first 100 cycles. In contrast, the addition of indium at the 3.9 wt percent level markedly improved the cycle life. The capacity decline of the Li-Al-3.9 wt percent In alloy was less than 0.01 percent per deep cycle, which compares with about 0.06 percent per deep cycle for the binary Li-Al alloy electrode. Postoperative photomicrographic examinations of the active material in the lithium-metal alloy electrodes suggest that the indium additive results in a more dendritic-like material than that in the binary Li-Al alloy electrodes. ERA

N78-14678# Argonne National Lab., Ill.
ELECTROCHEMISTRY OF LITHIUM/METAL SULFIDE AND CALCIUM/METAL SULFIDE CELLS USING MOLTEN SALT ELECTROLYTES
R. K. Steunenberg and M. F. Roche 1977 24 p refs Presented at Meeting of the Electrochemical Soc., Philadelphia, Pa., 8 May 1977
(Contract W-31-109-eng-38)
(CONF-770531-1) Avail: NTIS HC A02/MF A01

The electrochemical properties of lithium/LiCl-KCl/metal sulfide and calcium/LiCl-KCl CaCl2/metal sulfide cells are described. These cells, which operate at about 700 K, employ intermetallic compounds (rather than elemental lithium or calcium) as their negative electrodes; the positive electrodes are usually iron sulfides, but a variety of other transition metal sulfides have also been tested in lithium cells. The cells with the highest power characteristics are based on the LiAl/FeS2 couple. This couple appears to be limited only by ohmic losses. A statistical model is required, however, to account for the variation in cell polarization with utilization of the electrodes. Results of a variety of metallographic and cyclic voltammetry studies are also described. ERA

N78-14679# Systems Consultants, Inc., Washington, D. C.
APPLICATION OF NEAR-TERM FOSSIL TECHNOLOGIES TO THE ENERGY SUPPLY/DEMAND PROFILES OF THE U.S. STATES AND REGIONS
Jan. 1977 186 p refs
(Contract EX-76-C-01-2442)
(FE-2442-1) Avail: NTIS HC A09/MF A01

Critical energy problems were surveyed based on energy supply and utilization. Areas with highest severity were the North Central, and the West South Central, the Middle Atlantic, the South Atlantic and New England. The following near-term technologies are most likely to have a major impact on the supply/demand energy characteristics of the regions: direct combustion of coal in atmospheric fluidized beds; low-Btu gas from coal for power generation and combined cycles; power plant technology; high-Btu gasification in entrained and fluidized beds; improved railroad coal-handling facilities; direct combustion by fuel substitution; low-Btu gas for process heat; improved underground and surface coal extraction techniques; coal slurry and coal-gas pipeline transport systems; and conservation in the residential/commerical and vehicular transportation sectors. ERA

N78-14680# Energy Research and Development Administration, Washington, D. C. Div. of Solar Energy.
SOLAR PROGRAM ASSESSMENT: ENVIRONMENTAL FACTORS. SOLAR HEATING AND COOLING OF BUILDINGS
Mar. 1977 79 p refs
(ERDA-77-47/1) Avail: NTIS HC A05/MF A01

The major environmental issues associated with the further development of solar heating, heating and cooling, and domestic hot water systems are presented. To provide a background for this environmental analysis, the basic concepts of the technology are reviewed, as are its material resource requirements. The potential effects of this technology on the full range of environmental concerns (i.e., air and water quality, biosystems, safety, social/institutional structures, etc.) are then discussed in terms of both their relative significance and possible solutions. Although the further development of solar heating and cooling will contribute in some ways to environmental problems common to any construction project or space conditioning technology (e.g., noise from cooling towers), only those problems unique to the solar portion of the technology will be discussed in depth. Finally, an environmental work plan is presented, listing research and development proposals and a National Environmental Policy Act (NEPA) document work plan which might help clarify and/or alleviate specific environmental problems. ERA

N78-14681# Energy Research and Development Administration, Washington, D. C. Div. of Solar Energy.
SOLAR PROGRAM ASSESSMENT: ENVIRONMENTAL FACTORS
Mar. 1977 75 p refs
(ERDA-77-47/4) Avail: NTIS HC A04/MF A01
For abstract, see N78-14680.

N78-14682# Energy Research and Development Administration, Washington, D. C. Div. of Solar Energy.
SOLAR PROGRAM ASSESSMENT: ENVIRONMENTAL FACTORS. WIND ENERGY CONVERSION
Mar. 1977 42 p refs
(ERDA-77-47/6) Avail: NTIS HC A03/MF A01

The major environmental issues associated with the further development of Wind Electric Conversion (WEC) systems are presented and prioritized. To provide a background for this environmental analysis, the basic concepts of the technology are reviewed, as are its resource requirements. The potential effects of this technology on the full range of environmental concerns are then discussed in terms of both their relative significance and possible solutions. Although the development

of WEC will in some ways contribute to environmental problems common to any construction project or energy producing technology, only those impacts unique to the solar/wind portion of the technology are discussed in depth. ERA

N78-14683# Energy Research and Development Administration, Washington, D. C. Div. of Solar Energy.
SOLAR PROGRAM ASSESSMENT: ENVIRONMENTAL FACTORS. OCEAN THERMAL ENERGY CONVERSION
Mar. 1977 55 p refs
(ERDA-77-47/8) Avail: NTIS HC A04/MF A01

The environmental problems which may arise with the further development of Ocean Thermal Energy Conversion (OTEC), are presented. To provide a background for this environmental analysis, the history and basic concepts of the technology are reviewed, as are its economic and resource requirements. The potential effects of this new technology on the full range of environmental concerns (i.e., air etc.) are then discussed in terms of both their relative significance and possible solutions. Although the emerging solar technologies will contribute to environmental problems common to any construction project or energy-producing technology (e.g., air pollutants from steel production), only those impacts unique to the solar aspects of the technology are discussed in depth. Finally, an environmental work plan is presented listing research and development proposals and a work plan which might help clarify and/or mitigate specific environmental concerns. ERA

N78-14684# Central Technical Inst. TNO, Apeldoorn (Netherlands).
SURVEY OF RESEARCH AND DEVELOPMENT ACTIVITIES IN THE NETHERLANDS ON HEAT PUMPS FOR RESIDENTIAL HEATING
H. VanDerRee 21 Sep. 1976 35 p refs In DUTCH; ENGLISH summary Presented at the Ver. van Exploitanten van Electriciteitsbedrijven in Ned. (VEEN), 21 Sep. 1976
(CTI-76-09497) Avail: NTIS HC A03/MF A01

A survey is given of projects at various institutes and private companies. Design and implementation are described for each project, particular attention being paid to the scope of the activities. It is concluded that, at the moment, efforts among all kinds of institutions fritter away to an ever increasing extent, and a strong plea is put in for coordination. Another point that emerges from the survey is that it is by no means clear what modification of heat pump will gain the upper hand in the Netherlands. On the whole the competitive power of the heat pump is still very low compared to that of the conventional heating system with natural gas. Some outlines are given for further investigations. Author (ESA)

N78-14685# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
PHOTOVOLTAIC SOLAR PANELS AND SOLAR MODULES [PANNELLI E MODULI SOLARI FOTOVOLTAICI]
G. V. Pallottino May 1977 24 p refs In ITALIAN
(LPS-77-12) Avail: NTIS HC A02/MF A01

The possibilities offered by photovoltaic cells to convert, directly, solar energy into electric energy are discussed briefly. Research being carried out to reduce the production costs of such cells is reviewed. The principle characteristics of solar panels and modules for terrestrial use are reviewed. ESA

N78-14686# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Raumsimulation.
SOME EXPERIMENTAL RESULTS ON SELECTIVE ABSORBING SURFACES FOR LOW TEMPERATURE SOLAR COLLECTORS
Georg Paul Goerler 27 May 1977 50 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-432)
(DLR-FB-77-23) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 25

The efficiency of a flat plate solar collector can be greatly enhanced by the use of a selectively absorbing layer, that is, a surface with high absorptance for the solar spectrum and low emittance for thermal radiation. From various methods known from literature for realizing coatings with these properties, the process of electroplating selective black nickel coatings was chosen and studied in detail. One result of this investigation was that the effectiveness of these layers results from optical interference. With the production of black nickel two-layer coatings on a copper substrate one obtains surfaces with an absorptance as high as 0.95, when weighted with the terrestrial solar spectrum. The simultaneous emittance is in the order of 0.05. The superiority of absorber plates with such values, in comparison with nonselective solar collectors is outlined using the results of a numerical calculation. Author (ESA)

N78-14687# Resource Planning Associates, Inc., Cambridge, Mass.
WESTERN ENERGY RESOURCES AND THE ENVIRONMENT: GEOTHERMAL ENERGY
May 1977 117 p refs
(Contract EPA-68-01-4100)
(PB-271561/3; EPA-600/9-77-010) Avail: NTIS HC A06/MF A01 CSCL 08I

Geothermal energy is addressed from an environmental research and development perspective. Various geothermal energy systems are discussed which serve as present or potential energy sources. These include hydrothermal convection systems, such as geysers and hot springs, hot igneous systems, and conduction dominated systems. Special inserts describe how geothermal resource systems are created and developed. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N78-14688 British Library Lending Div., Boston Spa (England).
DEVELOPMENT OF AN ISOKINETIC DUST SAMPLER WITH BALANCED VENTURI TUBE PITOT TUBE DYNAMIC PRESSURE HEADS
K. Magami, N. Kogure, and I. Tamori 1976 20 p refs Transl. into ENGLISH from Kogai (Japan), v. 11, no. 3, 1976 p 121-130
(BLL-CE-Trans-7164-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.

An isokinetic dust sampler for estimating dust concentration in sources was developed. The principle of this null type sampler is based on balancing the differential head of Venturi tube placed after a dust filter with the kinetic pressure head of the Pitot tube aligned in a duct. Both differential head readings are compared with an inclined duplex manometer, and isokinetic sampling is accomplished by regulating the flow rate so that these readings are kept coincident. This procedure can also be made automatic by changing the sampling rate of a suction pump in accordance with the electronic signals gained by the change of isokinetic head of flue gas. Author

N78-14689*# National Aeronautics and Space Administration, Washington, D. C.
MEASUREMENT OF WAVELENGTH-DEPENDENT EXTINCTION TO DISTINGUISH BETWEEN ABSORBING AND NONABSORBING AEROSOL PARTICULATES
Rainer Portscht Dec. 1977 22 p refs Transl. into ENGLISH from Staub-Reinhaltung der Luft (West Ger.), v. 37, Feb. 1977 p 70-76 Original language document was announced as A77-25725 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original Doc. Prep. by Technische Hochschule, Aachen (Contract NASw-2790)
(NASA-TM-75172) Avail: NTIS HC A02/MF A01 CSCL 13B

Measurements of spectral transmission factors in smoky optical transmission paths reveal a difference between wavelength exponents of the extinction cross section of high absorption capacity and those of low absorption capacity. A theoretical explanation of this behavior is presented. In certain cases, it is possible to obtain data on the absorption index of aerosol particles in the optical path by measuring the spectral decadic extinction coefficient at, at least, two wavelengths. In this manner it is possible, for instance, to distinguish smoke containing soot from water vapor. Author

N78-14690# Air Force Systems Command, Wright-Patterson AFB, Ohio.
DETERMINATIONS OF POLLUTION CONCENTRATIONS BY MEASUREMENT TECHNIQUES AND CALCULATIONS, WITHIN THE RANGE OF INFLUENCE OF LARGE EMITTERS, AS A BASIS FOR EVALUATION FOR TERRITORIAL PLANNING
Herbert Mohry, Angela Lehmann, and Dieter Kahl 22 Feb. 1977 29 p Transl. into ENGLISH from Energietechnik (East Germany), v. 25, no. 3, 1975 p 93-100
(AD-A045923; FTD-ID(RS)I-0051-77) Avail: NTIS HC A03/MF A01 CSCL 13/2

This report shows how technical measurement analyses are carried out on the pollution burden in the German Democratic Republic, in accordance with the regulation on the maintenance of pure air by various institutions. With the help of a data bank, condensed information on the air hygiene situation is given to the responsible institutions and operations, primarily for use in the industrial areas. Newly developed mathematical models for the dissemination and dilution processes of air impurities can make prognostications on the development of the atmospheric hygienic burden in the area as a function of structural changes for hundreds of emission sources, by the use of electronic data processing installations. In these calculations, frequency statistical information on the dissemination conditions is taken into consideration. The results can be presented in tabular hard copy as well as in scaled charts according to the desired interrogation. Comparisons of measured and calculated pollution yield satisfactory agreement and can be drawn upon as a basis for evaluation of planning for new industrial operations. GRA

N78-14691# Defense Documentation Center, Alexandria, Va.
ENVIRONMENTAL POLLUTION. NOISE POLLUTION-NOISE EFFECTS ON HUMAN PERFORMANCE
Jun. 1977 325 p Supersedes DDC-TAS-71-39-1 and DDC-TAS-73-69
(AD-A041600; DDC/BIB-77/077) Avail: NTIS HC A14/MF A01 CSCL 06/19

This bibliography is a selection of unclassified and unlimited distribution references on Noise Pollution-Noise Effects on Human Performance. These citations of reports present information on noise effects on human performance such as motor reactions, hearing, speech, sleep, perception, nervous systems, visual signals and fatigue. Corporate Author-Monitoring Agency, Subject, Title and Personal Author are provided. Author (GRA)

N78-14692# Naval Weapons Center, China Lake, Calif.
GENERATION OF FUMES SIMULATING PARTICULATE AIR POLLUTANTS Final Report, Jan. 1975 - Apr. 1977
J. W. Carroz, F. K. Odencrantz, and W. G. Finnegan Jul. 1977 100 p
(PB-271989/6; EPA-600/2-77-132) Avail: NTIS HC A05/MF A01 CSCL 13B

Techniques are described which were developed for generating large quantities of reproducible, stable, inorganic, fine particle aerosol fumes. These fumes simulated particulate air pollutants and were generated by burning flammable solutions containing appropriate soluble compounds of the desired elements. In the flame, these compounds decomposed to oxides. Particle size determinations were made using scanning and transmission electron microscope photographic analysis of captured particles. GRA

N78-14693# PEDCO-Environmental Specialists, Inc., Cincinnati, Ohio.
STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES. SUPPLEMENT NO. 1. A COMPILATION AS OF MARCH 15, 1977 Final Report
15 Mar. 1977 77 p
(Contract EPA-68-02-1375)
(PB-271993/8; EPA-340/1-76-009a) Avail: NTIS HC A05/MF A01 CSCL 13B

Revisions which have appeared in the Federal Register since the publication of the handbook on August 1, 1976 are provided in this supplement. The full text of all revisions and other notices pertaining to the standards for air pollution are included as well as the full text of all proposed amendments as of March 15, 1977. GRA

N78-14694# Stanford Research Inst., Menlo Park, Calif. Atmospheric Sciences Lab.
OZONE IN CLEAN REMOTE ATMOSPHERES: CONCENTRATIONS AND VARIABILITIES Final Report
Hanwant B. Singh, Francis L. Ludwig, and Warren B. Johnson Jun. 1977 160 p
(PB-272290/8; CRC-APRAC-CAPA-15-76) Avail: NTIS HC A08/MF A01 CSCL 07E

A study to further understand the reasons for elevated oxidant levels in nonurban areas was described. Available field data dealing with nonurban photochemical air pollution were critically examined with major attention placed on such factors as the natural background distribution frequencies for ozone, hydrocarbons, and nitrogen oxides; correlations between rural ozone and meteorological variables, as well as geographical considerations; and of urban air intrusion upon the distribution frequency of natural ozone. Author

N78-14695# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A NEW APPARATUS TO STUDY THE MICROBIOLOGICAL CONTAMINATION OF AIR
Jacek Dutkiewicz and Czeslaw Kwapiszewski 14 Jun. 1977 25 p refs Transl. into ENGLISH from Ochr. Powietrza (Poland), v. 9, no. 2, 1975 p 37-42
(AD-A045993; FTD-ID(RS)T-0782-77) Avail: NTIS HC A02/MF A01 CSCL 06/3

The new apparatus determines accurately the total number of microorganism particles in a unit volume of air, and the size of respirable fraction of microorganism aerosol which could penetrate pulmonary alveola. The apparatus permits under various conditions the evaluation of microbiological health hazards, even in the case of air very strongly contaminated with microorganisms such as, in an environment contaminated with organic dusts. There is the possibility of an adaptation of apparatus to perform determinations of the contamination of air with impurities of other character. The described apparatus could find broad utilization in studies connected with protection of the natural environment of man, as well as in studies in the fields of medicine, agro-technology and zoo-technology. GRA

N78-14696# Sandia Labs., Albuquerque, N. Mex.
MODELING OF RAINSTORM AND PLUME INTERACTION FOR ATMOSPHERIC RELEASE OF EFFLUENTS
J. R. Wayland, W. D. Brown, and L. T. Ritchie 1977 11 p refs Presented at 1st Intern. Conf. on Math. Modeling, St. Louis, Missouri, 29 Aug. 1977
(Contract EY-76-C-04-0789)
(SAND-76-9302C; Conf-770816-3) Avail: NTIS HC A02/MF A01

A preliminary model describing the effects of washout and runoff on the developing plume from an atmospheric release of effluents is presented. The most important feature is the spatial structure of rainstorms consisting of four levels of rain activity that are normalized by average storm rainfall. The predicted concentrations of effluents are compared with those of a simplified homogeneous rainstorm with fixed meteorological conditions. In the case of individual storms, the air and ground concentrations are significantly different from those of the simplified homogeneous model. ERA

N78-14697# Oak Ridge National Lab., Tenn.
CHARACTER AND TRANSFORMATION OF POLLUTANTS FROM MAJOR FOSSIL FUEL ENERGY SOURCES
D. S. Shriner, S. B. McLaughlin, and C. F. Baes 1977 22 p Presented at Air Pollution Control Assoc. Meeting, Toronto, 19 Jun. 1977
(Contract W-7405-eng-26)
(CONF-770622-5) Avail: NTIS HC A02/MF A01

Factors influencing ecosystem effects of air pollutants from major fossil fuel energy sources were investigated. Chemical speciation of major effluents, the variations in source term associated with type of source, and other factors which influence the characteristics of the effluent at the source/atmosphere interface were discussed. The major current and potential sources of energy-derived pollutant burdens, and projected future patterns of energy production were reviewed. In addition, factors controlling transformation of pollutants during atmospheric transport were

described. The most critical controlling factors were identified, as were the major effluent constituents for which transformation was most significant. The chemical species which ultimately reach the atmosphere/vegetation interface were described with regard to their relative potential for effects on terrestrial ecosystems.
ERA

N78-14698# Oak Ridge National Lab., Tenn.
CHARACTER AND TRANSFORMATION OF POLLUTANTS FROM MAJOR FOSSIL FUEL ENERGY SOURCES
D. S. Shriner, S. B. McLaughlin, and C. F. Baes Jun. 1977 44 p refs
(Contract W-7405-eng-26)
(ORNL/TM-5919) Avail: NTIS HC A03/MF A01
For abstract, see N78-14697.

N78-14699# Chalmers Univ. of Technology, Goteborg (Sweden). Research Lab. of Electro-Optics and Lasers.
A PbSe DIODE LASER SPECTROMETER TO BE USED IN AIR POLLUTION MONITORING AND MINERAL PROSPECTING
E. Max and S. T. Eng [1977] 21 p refs Sponsored by Swed. Board for Tech. Develop.
(CTH-IEM-TR-7636) Avail: NTIS HC A02/MF A01
The high resolution infrared PbSe diode laser spectrometer developed possesses three cells for measurement and calibration. A correlation technique was applied to increase sensitivity. Silicon dioxide concentrations of around 5 ppm were monitored at 7.5 microns with the diode operating at 77 K. Author (ESA)

N78-14700# Environmental Protection Agency, Washington, D. C. Office of Monitoring and Technical Support.
QUALITY ASSURANCE RESEARCH PLAN, FISCAL YEAR 1978 - 1982
Thomas W. Stanley Jul. 1977 70 p
(PB-272421/9; EPA-600/8-77-008) Avail: NTIS HC A04/MF A01 CSCL 13B
The Office of Research and Development (ORD) is responsible for developing a quality assurance program to enable the U. S. Environmental Protection Agency to implement its regulatory mission and associated monitoring functions. The resources required by ORD to develop the quality assurance tools, techniques, and services needed by other program offices, the Regions, and the States to generate valid data, are identified and justified. The quality assurance program is described in terms of goals, objectives, and functional elements; the current status of ORD's ongoing quality assurance efforts is summarized; and Agency and program needs are discussed. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N78-14701 British Library Lending Div., Boston Spa (England).
USE OF SATELLITE TV INFORMATION FOR AEROLOGICAL PURPOSES
N. K. Vinnichenko and A. D. Dobrozrakov [1977] 6 p refs Transl. into ENGLISH from TR. Tsent. Aerol. Observ. (USSR), no. 117, 1976 p 56-59 In RUSSIAN and English
(BLLD-M-24912-(5828.4F); BLLD-Trans-1282) Avail: British Library Lending Div., Boston Spa, Engl.

The development of TV technology and remote sounding technology was investigated in regard to its impact on aerology. Advantages foreseen through the use of satellite TV include the overall global coverage of meteorological elements, as well as simultaneous measurement of quantitative features and the formation of an image of the item surveyed with a view to its identification on a photograph. It is suggested that in the near future, operating ranges of TV systems will be extended into the ultraviolet region and the infrared zone, with the objective of stepping up the reliability of information produced and of recording fresh data on the parameters of the atmosphere.
Author

N78-14702 British Library Lending Div., Boston Spa (England).
RADIATIVE PROPERTIES OF A CLOUDY ATMOSPHERE, FROM AIRCRAFT OBSERVATIONS
V. J. Shlyakov and L. J. Markosova [1977] 5 p refs Transl. into ENGLISH from Nauchn.-Issled. Gidromet. Inst., Radiat. Process. Atmos. Earth's Surf. (Kiev), 1974 p 52-56
(BLLD-M-24901-(5828.4F); BLLD-Trans-1271) Avail: British Library Lending Div., Boston Spa, Engl.
The radiative properties of various cloud formations are examined. The mean radiative cooling and the limits of its variation, equations linking the radiative characteristics of a cloud with its microstructure, the optical thickness of a cloud, and the temperature distribution within a cloud are among the topics discussed. J.M.S.

N78-14703 British Library Lending Div., Boston Spa (England).
TIME VARIABILITY IN ATMOSPHERIC TURBIDITY
O. D. Barteneva, L. K. Veselova, and N. I. Nikitinskaya [1977] 11 p refs Transl. into ENGLISH from Ukr. Nauch.-Issled. Gidromet. Inst., Radiat. Process. Atmos. Earth's Surf. (Kiev), 1974 p 223-227 In RUSSIAN and ENGLISH
(BLLD-M-24948-(5828.4F); BLLD-Trans-1293-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.
The variability of the atmosphere's aerosol component was investigated. An aerosol was determined to be largely a product of interaction between the atmosphere and the underlying surface. Certain tendencies in the variability of atmospheric turbidity were observed by comparing data on the diurnal variations at selected representative points with sharply differing physico-geographical conditions, in particular concerning the underlying surface. Statistical processing was done, from 1959 through 1968, for a series of synoptic observations of direct radiation from April to October for the meteorological stations at Akmolla and Tamdy, and from 1959 through 1962 for two stations in the Leningradskaya Oblast'. Author

N78-14704 British Library Lending Div., Boston Spa (England).
CHARACTERISTICS OF THE FLUX OF ULTRA-VIOLET RADIATION UNDER DIFFERENT CONDITIONS OF CLOUD COVER
M. P. Garadzha [1977] 10 p refs Transl. into ENGLISH from Ukr. Nauch.-Issled. Gidromet. Inst., Radiat. Process. Atmos. Earth's Surf. (Kiev), 1974 p 261-264 In Russian and English (BLL-M-24949-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.
Unbroken observations on global and diffuse ultraviolet radiation were made from 1967 through 1969. Hourly observations on cloud type and amount, and the state of the solar disc over the same period were recorded. Measurements were made by a photoelectric instrument of integral type in the range where lambda is less then 400 nm. Results, given in tabular form, indicate seasonal variations of radiation due to the amounts of atmospheric moisture and secondary reflection from snow and lower cloud layers. Author

N78-14705 California Univ., Los Angeles.
DEVELOPMENT AND VALIDATION OF A TWO-DIMENSIONAL TRANSPORT MODEL FOR PHOTOCHEMICAL SMOG IN A MIXING LAYER Ph.D. Thesis
Parveen Kumar Amar 1977 284 p
Avail: Univ. Microfilms Order No. 77-19624
An Eulerian transport model for photochemical smog in an urban airshed employing the shallow water approximation is presented. The simulation for carbon monoxide, nitrogen oxides, ozone, and reactive hydrocarbons from Los Angeles demonstrate

that this formulation is capable of producing realistic results without requiring a prohibitive amount of computer time and storage, primarily due to the assumption of two dimensionality.
Dissert. Abstr.

N78-14706# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
STRATOSPHERIC DUST M.S. Thesis [POEIRA ESTRATOSFERICA]
Walter Moreira Lima Oct. 1977 125 p refs In PORTUGUESE; ENGLISH summary
(INPE-1135-TPT/071) Avail: NTIS HC A06/MF A01

The time variations of the abundance of stratospheric dust are described. The analysis was based on stratospheric scattering profiles obtained by laser radar. Observations were made at INPE, Sao Jose dos Campos, from July 1970 to February, 1977. In mid October, 1974, the Fuego Volcano in Guatemala underwent a large eruption throwing large quantities of dust and ashes into the atmosphere. Dust particle densities were determined by comparison of measured backscattering ratios with the accumulative volume backscattering coefficient. The main conclusions are: the stratospheric dust concentrations were small and constant, at June layer heights, from 1973 to 1974; an increase in the dust concentration occurred beginning in April, 1975; a decrease followed from December, 1975 to March, 1976, after which the concentrations stabilized to equilibrium values. Author

N78-14707# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
PROJECT PORCUPINE. SUMMARY OF SCIENTIFIC OBJECTIVES AND INSTRUMENTATION
G. Haerendel, ed. Feb. 1976 104 p refs
(MPI-PAE/EXTRATERR-121A) Avail: NTIS HC A06/MF A01

Scientific objectives and instrumentation of the Porcupine experiments are presented. The name of the Porcupine project, a sounding rocket research of the near earth plasma program, is derived from the many booms equipped with electrodes and sensors sticking out from the payload. The project is part of the Federal Republic of Germany sounding rocket program. Eight experiments are fully or partially supplied by German physicists. Six groups from the USA, Netherlands, France, Austria, and the USSR provide 7 of the experiments. The Aries vehicle is a one stage, solid fuel, steerable sounding rocket developed by Space Vector Corporation, Los Angeles. The launch window extends for periods of 1 or 2 hours every night between March 17 and April 3, 1976. A second round of two Aries flights is scheduled for Sept./Oct. 1977 in conjunction with the GEOS satellite of ESA. For individual titles, see N78-14708 through N78-14724.

N78-14708# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany).
MEASUREMENT OF THE STATIC ELECTRIC FIELD WITH DOUBLE PROBES
R. Grabowski and H. Wolf *In its* Proj. Porcupine. Sum. of Sci. Objectives and Instr. Feb. 1976 p 8-16 refs (For availability see N78-14707 05-46)
Avail: NTIS HC A06/MF A01

The double probe measurement of the static electric field resulting from the interaction of the hot magnetospheric plasma with the relatively cool ionospheric plasma is discussed, with emphasis on the measuring technique. ESA

N78-14709# European Space Research and Technology Center, Noordwijk (Netherlands).
DESCRIPTION OF AC ELECTRIC FIELD EXPERIMENT
A. Pedersen *In* Max-Planck-Inst. fuer Phys. u. Astrophys. Proj. Porcupine. Sum. of Sci. Objectives and Instr. Feb. 1976 p 17-21 (For availability see N78-14707 05-46)
Avail: NTIS HC A06/MF A01

Scientific amis of the ac electric field experiment, capable of measuring three components of electric fields in the frequency range 50 Hz-20 Hz are outlined and technical details of the experiment are given. The experiment is similar to part of the S-300 experiment on GEOS and has successfully been tested on a Black Brant rocket launched from Andorra in 1974. ESA

N78-14710# Cornell Univ., Ithaca, N. Y.
SOME ASPECTS OF THE DELTA N EXPERIMENT ON PORCUPINE
M. C. Kelley *In* Max-Planck-Inst. fuer Phys. u. Astrophys. Proj. Porcupine. Sum. of Sci. Objectives and Instr. Feb. 1976 p 22-29 refs (For availability see N78-14707 05-46)
Avail: NTIS HC A06/MF A01

Objectives, significant aspects and technicalities of the Delta N experiment are given. Some features of Delta N are: (1) sensitive to electrostatic waves; (2) frequency response in excess of that required to detect waves with omega approximately equal to omega sub pi; (3) rejection of spurious potential fluctuations of the vehicle potential. ESA

N78-14711# Institut fuer Physikalische Weltraumforshung, Freiburg (West Germany).
RETARDING POTENTIAL ANALYZER FOR THE IMS PROJECT PORCUPINE
K. Spenner and W. Ott *In* Max-Planck-Inst. fuer Phys. u. Astrophys. Proj. Porcupine. Sum. of Sci. Objectives and Instr. Feb. 1976 p 30-33 (For availability see N78-14707 05-46)
Avail: NTIS HC A06/MF A01

Objectives and measurement method of the retarding potential analyzer, measuring primarly the energy distribution of the thermal and superthermal electrons up to 30 eV, are presented. ESA

N78-14712# Centre de Recherches en Physique de l'Environnement Terrestre et Planetaire, Orleans (France).
PROJECT PORCUPINE. THE RADIO FREQUENCY PROBE EXPERIMENT
L. R. O. Storey, Principal Investigator *In* Max-Planck-Inst. fuer Phys. u. Astrophys. Proj. Porcupine. Sum. of Sci. Objectives and Instr. Feb. 1976 p 34-44 (For availability see N78-14707 05-46)
Avail: NTIS HC A06/MF A01

Objectives and experimental techniques of the radio frequency probe experiment are presented. The field aligned drift velocity of thermal electrons will be determined from the electron density and temperature and from the frequency shift of the lower oblique resonance. ESA

N78-14713# Technische Universitaet, Brunswick (West Germany). Inst. fuer Geophysik und Meteorologie.
VECTOR MAGNETOMETER
B. Theile *In* Max-Planck-Inst. fuer Phys. u. Astrophys. Proj. Porcupine. Sum. of Sci. Objectives and Instr. Feb. 1976 p 45-48 (For availability see N78-14707 05-46)
Avail: NTIS HC A06/MF A01

Scientific objectives and measuring techniques of the magnetometer to be used to measure the magnetic fields of magnetospheric and ionospheric current during a magnetospheric substorm, are presented. ESA

N78-14714# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
IMS-ARIES SEARCH COIL EXPERIMENT
Bernd Haeusler and M. C. Kelley (Cornell Univ., Ithaca, N. Y.) *In* Max-Planck-Inst. fuer Phys. u. Astrophys. Proj. Porcupine. Sum. of Sci. Objectives and Instr. Feb. 1976 p 49-53 (For availability see N78-14707 05-46)
Avail: NTIS HC A06/MF A01

Scientific objectives and measuring method of the search coil experiment for the detection of the magnetic components of ionospheric and lower magnetospheric waves in the frequency range 10 to 500 Hz, are presented. ESA

N78-14715# Max-Planck-Institut fuer Aeronomie, Lindau Uber Northeim (West Germany).
SUPRATHERMAL ELECTRON EXPERIMENT (KL 7), EXPERIMENT NO. 8A ON THE PORCUPINE PAYLOAD
K. Wilhelm, K.-H. Saeger, C. Becker, R. Schmidt, and W. Engelhardt *In* Max-Planck-Inst. fuer Phys. u. Astrophys. Proj. Porcupine. Sum. of Sci. Objectives and Instr. Feb. 1976 p 54-65 (For availability see N78-14707 05-46)
Avail: NTIS HC A06/MF A01

The scientific objectives and measuring method of the suprathermal electron experiment for measuring the distribution function of suprathermal electron fluxes are presented. Charge

and energy selection will be performed by a Differential Energy and Angle Analyzer (DEAA). ESA

N78-14716# Technische Hochschule, Graz (Austria). Inst. fuer Nachrichtentechnik und Wellenausbreitung.
LOW ENERGY PROTON EXPERIMENT
W. Riedler and A. Dallas *In* Max-Planck-Inst. fuer Phys. u. Astrophys. Proj. Porcupine. Sum. of Sci. Objectives and Instr. Feb. 1976 p 66-70 (For availability see N78-14707 05-46)
Avail: NTIS HC A06/MF A01

Scientific objectives and measuring techniques of the low energy proton experiment are presented. Continuous channel electron multipliers will be used as detectors. ESA

N78-14717# Max-Planck-Institut fuer Aeronomie, Lindau Uber Northeim (West Germany).
ENERGETIC PARTICLE DETECTOR KL 6 (EXPERIMENT 9) ON BOARD THE PORCUPINE PAYLOAD
W. Stuedemann, A. Korth, and H. P. Winterhoff *In* Max-Planck-Inst fuer Phys. u. Astrophys. Proj. Porcupine. Sum. of Sci. Objectives and Instr. Feb. 1976 p 71-78 (For availability see N78-14707 05-46)
Avail: NTIS HC A06/MF A01

The scientific objectives and measuring technique of the energy particle detector project to measure the energy and pitch angle distribution of electrons and protons in the keV-range are presented. ESA

N78-14718# California Univ., Berkeley. Lab. of Space Sciences.
DESCRIPTION OF THE ARIES EJECTABLE PAYLOADS
F. S. Mozer, K. A. Anderson, C. W. Carlson, and M. C. Kelley *In* Max-Planck-Inst. fuer Phys. u. Astrophys. Proj. Porcupine. Sum. of Sci. Objectives and Instr. Feb. 1976 p 79-80 (For availability see N78-14707 05-46)
Avail: NTIS HC A06/MF A01

The Aries ejectable payload, a 24 inch long, 9 inch diameter cylinder weighing 40 pounds, is briefly described. ESA

N78-14719# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
PORCUPINE EXPERIMENT 11: BARIUM ION JET
G. Haerendel, A. Valenzuela, E. Rieger, and H. Foeppl *In its* Proj. Porcupine. Sum. of Sci. Objectives and Instr. Feb. 1976 p 81-87 (For availability see N78-14707 05-46)
Avail: NTIS HC A06/MF A01

Scientific objectives and technical data of the barium ion jet experiment to probe the electric field as a function of altitude, are presented. ESA

N78-14720# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
PORCUPINE EXPERIMENT 12: CESIUM PLASMA SOURCE
R. Z. Sagdeev (Space Res. Inst., Moscow), I. A. Zhulin (Inst. of Terrest. Magnetism, Ionosphere and Radio Propagation, Moscow), V. A. Dokukine (Inst. of Terrest. Magnetism, Ionosphere and Radio Propagation, Moscow), J. J. Ruzhin (Inst. of Terrest. Magnetism, Ionosphere and Radio Propagation, Moscow), and G. Haerendel *In its* Proj. Porcupine. Sum. of Sci. Objectives and Instr. Feb. 1976 p 88-92 (For availability see N78-14707 05-46)
Avail: NTIS HC A06/MF A01

Scientific objectives and technical data of the cesium plasma experiment are given. The projects are designed to study, free from the influence of walls on collisions with the ambient medium, the initial expansion of the beam in the earth's magnetic field and its subsequent adaption to the state of convection of the background plasma. ESA

N78-14721# Technische Universitaet, Brunswick (West Germany). Inst. fuer Geophysik und Meteorologie.
MAGNETOMETER CHAIN OF THE TECHNICAL UNIVERSITY BRUNSWICK
W. Kertz and H. Maurer *In* Max-Planck-Inst. fuer Phys. u. Astrophys. Proj. Porcupine. Sum. of Sci. Objectives and Instr. Feb. 1976 p 93-94 (For availability see N78-14707 05-46)
Avail: NTIS HC A06/MF A01

The technical characteristics of the magnetometers that will take samples of the H, D and Z components every 5 sec for the entire period of the Porcupine project are summarized. ESA

N78-14722# Muenster Univ. (West Germany). Inst. fuer Geophysik.
ARRAY OF 30 MAGNETOMETERS FOR GROUND-BASED OBSERVATION OF IONOSPHERIC CURRENTS IN NORTHERN SCANDINAVIA
J. Untiedt and F. Kueppers *In* Max-Planck-Inst. fuer Phys. u. Astrophys. Proj. Porcupine. Sum. of Sci. Objectives and Instr. Feb. 1976 p 95-100 Sponsored by Deut. Forschungsgemeinschaft (For availability see N78-14707 05-46)
Avail: NTIS HC A06/MF A01

The network of 30 magnetometers in northern Scandinavia for observation of ionospheric currents is briefly dealt with. ESA

N78-14723# Goettingen Univ. (West Germany). Inst. fuer Geophysik.
RECORDING OF GEOMAGNETIC PULSATIONS AT THREE STATIONS IN NORTHERN SCANDINAVIA DURING THE PORCUPINE EXPERIMENT
M. Siebert, H. Voelker, and O. Hillebrand *In* Max-Planck-Inst. fuer Phys. u. Astrophys. Proj. Porcupine. Sum. of Sci. Objectives and Instr. Feb. 1976 p 101 (For availability see N78-14707 05-46)
Avail: NTIS HC A06/MF A01

The procedure to record the three components H, D and Z of the geomagnetic pulsations at three stations in Northern Scandinavia in the period 10 March to 15 April 1976 is briefly described. ESA

N78-14724# Max-Planck-Institut fuer Aeronomie, Lindau Uber Northeim (West Germany).
IMS GROUND-BASED OBSERVATIONS
P. Czechowsky, G. Lange-Hesse, and H. Lauche *In* Max-Planck-Inst. fuer Phys. u. Astrophys. Proj. Porcupine. Sum. of Sci. Objectives and Instr. Feb. 1976 p 102-103 (For availability see N78-14707 05-46)
Avail: NTIS HC A06/MF A01

The operation of a continuous wave aurora backscatter system in Sweden with a transmitter near Borlaenge and a receiving station at Lycksele is briefly described. ESA

N78-14725# Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Sciences.
MICROCRACK TECHNOLOGY FOR GEOTHERMAL EXPLORATION AND ASSESSMENT
Gene Simmons 1 Jul. 1977 167 p refs
(Grant NSF AER-75-09588)
(PB-271940/9; NSF/RA-770179) Avail: NTIS HC A08/MF A01 CSCL 08I

An investigation to determine if the data obtained from microcracks in rocks can be useful in geothermal exploration, and to demonstrate how to use this data for reservoir assessment was initiated. The microcracks and various physical properties of cores of six geothermal areas were studied: Dunes, Heber, and Coso Hot Springs in California; Raft River, Idaho; Marysville, Montana; and Roosevelt Hot Springs, Utah. The fractures in the core samples and their characteristics were studied by a variety of techniques. The open fracture content was examined by differential strain analysis (DSA). The DSA technique provided a precise measure of fracture porosity as a function of pressure.
Author

N78-14726# Massachusetts Inst. of Tech., Cambridge.
STRONG-MOTION DURATION OF EARTHQUAKES Research Report, Oct. 1976 - Jul. 1977
Erik H. Vanmarcke and Shih-Sheng P. Lai Jul. 1977 38 p refs
(Grant NSF ENV-76-19021)
(PB-272001/9; R77-16) Avail: NTIS HC A03/MF A01 CSCL 13M

A simple procedure was proposed to estimate the strong motion duration of earthquake motions. The proposed strong motion duration is nearly proportional to the quantity (I sub 0)/(a(max)squared), in which a(max) is the maximum ground acceleration and I sub 0 is the integral of the squared accelerations.

The proportionality factor is weakly dependent on the predominant period of the ground motion. The procedure was applied to 140 horizontal components of strong earthquake ground motions. The results are tabulated and summarized in the form of histograms. The dependence of strong motion duration on earthquake magnitude and epicentral distance also was examined. Author

N78-14727# Yale Univ., New Haven, Conn.
ELECTRON-ATOM AND ELECTRON-MOLECULE CROSS SECTIONS APPLICABLE TO ATMOSPHERIC AND IONOSPHERIC BEHAVIOR Final Report, 1 Jul. 1970 - 30 Jun. 1976
Vernon W. Hughes 25 Oct. 1977 7 p refs
(Contract N00014-76-C-0077)
(AD-A046245) Avail: NTIS HC A02/MF A01 CSCL 20/8

Polarized electrons have been produced by photoionization of polarized alkali atoms by unpolarized light and also by photoionization of unpolarized alkali atoms by polarized light (Fano effect). Practical sources based on these approaches have been made. The first experiment to study the low energy scattering of polarized electrons by polarized atoms (electron-hydrogen) has been done with the Fano effect source. The other source provides polarized electrons for acceleration to high energies at SLAC and has been used in basic pioneering experiments in elementary particlephysics. The atomic scattering studies with polarized electrons improve our understanding of the approximations in theoretical calculations of electron-atom scattering cross section. Author (GRA)

N78-14728# Naval Ocean Systems Center, San Diego, Calif.
AEROSOL EXTINCTION OF PHOTOPIC AND IR WAVELENGTHS. DEMONSTRATED RELATIONSHIP OF VISIBILITY OF ATMOSPHERIC LIQUID WATER SUGGESTS THAT ATMOSPHERIC TRANSMITTANCE FOR IR CAN BE ESTIMATED BY USE OF SIMPLE MEASUREMENTS AND SCALING LAWS Final Report, Oct. 1976 - Jun. 1977
H. G. Hughes 23 Aug. 1977 18 p refs
(AD-A046118; NOSC/TR-143) Avail: NTIS HC A02/MF A01 CSCL 08/3

Marine aerosol-size distributions are measured and scaling laws derived to relate the photopic and infrared extinction coefficients for differing visibility conditions. It is shown that simple linear relationships can be derived for this purpose by use of the measured distributions and Mie theory. Linear relationships can also be derived to relate wavelength-dependent extinctions to atmospheric liquid water content. Comparison of extinctions predicted analytically on the basis of accepted fog aerosol models and those numerically derived from measured distributions indicates that the contributions from particles having diameters greater than 30 micrometers may significantly alter the derived scaling laws. Author (GRA)

N78-14729# Geological Survey, Denver, Colo.
BOREHOLE GRAVITY SURVEY TO DETERMINE DENSITY VARIATIONS IN THE DEVONIAN SHALE SEQUENCE OF LINCOLN COUNTY
James W. Schmoker May 1977 19 p refs
(Contract EX-76-C-01-2287)
(MERC/CR-77/7) Avail: NTIS HC A02/MF A01

In situ bulk densities of the devonian shale section in Lincoln County, West Virginia, were determined using the U.S. Geological Survey-LaCoste and Romberg borehole gravity meter. Densities from two gamma-gamma logs, run by different companies, were also available. A cumulative difference of .034 g/cu cm/1000 ft exists between the two gamma-gamma logs. The two intervals of lowest density derived from the borehole gravity data show higher densities on both gamma-gamma logs, possibly indicative of the deeper investigation radius of the borehole gravity meter. In most intervals, higher gamma ray intensity correlated with lower density, indicating that organic content is the primary variable affecting both bulk density and uranium concentration. ERA

N78-14730# Brookhaven National Lab., Upton, N. Y.
TRANSPORT OF OZONE ASSOCIATED WITH AN AIR MASS
George T. Wolff, P. J. Lioy, G. D. Wight, R. E. Meyers, and R. T. Cederwall 1977 17 p refs Presented at Air Pollution Control Assoc. Meeting, Toronto, Canada, 19 Jun. 1977
(Contract EY-76-C-02-0016)
(BNL-22569; Conf-770622-3) Avail: NTIS HC A02/MF A01

Data from daily ozone maps, aerial ozone measurements, and trajectory analysis are used to describe the typical summertime ozone episode in the Moodus study area. The results indicate that ozone concentrations in a high pressure system as it moves out of Canada into the Midwest are typically 30-50 ppb. Higher concentrations first develop over the areas of high anthropogenic precursor emissions. As the high pressure moves eastward, the areas of high ozone increase in size and concentration and eventually merge together. Vertical ozone profiles conducted on consecutive days and nights suggest an ozone half-life of 29.4 h above the nocturnal inversion layer. Using the corresponding dark phase rate of ozone decay in conjunction with air parcel trajectories, it was estimated that, under certain conditions, over 100 ppb of ozone are transported from the Midwest to the Northeastern Atlantic Coast. ERA

N78-14731# World Meteorological Organization, Geneva (Switzerland).
SCIENTIFIC WORKSHOP ON ATMOSPHERIC CARBON DIOXIDE
1977 41 p Conf. held at Washington, 28 Nov. - 3 Dec. 1976 Prepared jointly with UN Environ. Programme
(WMO-474; ISBN-92-63-10474-3) Avail: NTIS HC A03/MF A01; WMO, Geneva

The present state of knowledge on the atmospheric carbon dioxide problem, fossil fuel CO2 emission, and growth of CO2 concentration in the atmosphere is reviewed, and the possible climate modifications due to increased CO2 in the atmosphere are discussed. Recommendations for atmospheric, oceanic, and biosphere monitoring and research to improve predictions of future CO2 content as well as recommendations for study of polar ice changes due to possible atmospheric warming are presented. ESA

N78-14732# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.
ATMOSPHERIC PHYSICS AS A MEANS OF ENVIRONMENTAL RESEARCH [DIE PHYSIK DER ATMOSPHAERE ALS MITTEL DER UMWELTFORSCHUNG]
D. Paffrath Apr. 1975 31 p ref In GERMAN
(DLR-IB-553-75/7) Avail: NTIS HC A03/MF A01

The activities at the Institute for Atmospheric Physics are reported. The topics covered are: atmospheric measurement techniques, atmospheric effects on traffic systems, anthropogenic effects on the atmospheric environment, and atmospheric radiation and cloud physics. ESA

N78-14733# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.
PARAMETERS FOR INDICATION OF ATMOSPHERIC OZONE CONTENT [GROESSEN ZUR ANGABE DES OZONGEHALTES DER ATMOSPHAERE]
W. Boegel 21 Jun. 1976 38 p refs In GERMAN
(DLR-IB-553-76/1) Avail: NTIS HC A03/MF A01

The most frequently used parameters for indicating atmospheric ozone content are defined, and equations are derived for conversion of parameters. ESA

N78-14734# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.
RADIOSONDE FOR MEASUREMENT OF THE RADIANT FLUX DENSITY FROM THE UPPER AND LOWER HEMISPHERE IN THE SOLAR SPECTRAL RANGE [EINE RADIOSONDE ZUR MESSUNG DER STRAHLUNGSFLUSSDICHTEN AUS DEM OBEREN UND DEM UNTEREN HALBRAUM IM SOLAREN SPEKTRALBEREICH]
H. Queck 25 Feb. 1977 84 p refs In GERMAN; ENGLISH summary
(DLR-IB-553-77/2) Avail: NTIS HC A05/MF A01

A radiosonde which allows measurements of the incoming radiant flux from the upper hemisphere and the reflected radiant

flux from the lower hemisphere is described. The spectral sensitivity of the receivers was selected to give results of the hemispherical radiant flux densities in the optical centers of 550 and 684 nm. The calibration procedure is described, and the data acquisition and evaluation is explained. An error analysis is carried out. Results of the ascents during the 1969 Atlantic expedition are summarized. Author (ESA)

N78-14735# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).

STABILITY OF TEARING MODES IN PRESENCE OF A VELOCITY FLOW

M. Dobrowolny May 1977 23 p refs

(LPS-77-13) Avail: NTIS HC A02/MF A01

Tearing modes, driven by plasma resistivity, collisional or collisionless, are one of the possible mechanisms leading to reconnection of initially antiparallel magnetic field lines. The theory of stability of a neutral sheet configuration, with respect to tearing modes was developed including the presence of a plasma velocity flow and velocity gradients across the sheet. Consideration of the effects of a velocity flow are of noticeable importance as the magnetic configurations which are encountered in space and where reconnection processes may occur, are all accompanied by velocity flows. This is, for example, the case for the neutral sheet in the earth's magnetotail, the magnetopause boundary, and the boundaries between different sectors of the interplanetary magnetic field. Author (ESA)

N78-14736# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.

POSSIBLE MODELS FOR QUASI-PERIODIC ELECTRIC FIELDS AND ASSOCIATED ELECTRON PRECIPITATION AS OBSERVED IN THE AURORAL ZONE

E. F. Petelski, U. Fahleson, and S. D. Shawhan (Iowa Univ.) Feb. 1977 102 p refs Sponsored in part by ESA

(Grant NSF ATM-76-82739)

(TRITA-EPP-77-06) Avail: NTIS HC A06/MF A01

Spectral and polarization properties of quasi-periodic electric fields observed during rocket sounding in the nighttime auroral arc and in the polar cleft suggest that they represent the electric components of Pc1 or Pi1 micropulsations. To model these waves and the concurrent electron flux variations, different mechanisms for wave excitation, electron acceleration, and wave-particle interaction are considered. One likely interpretation attributes the micropulsations to Birkeland current chopping by an unstable double layer located at about 1 earth radius altitude. The double layer is also assumed to accelerate the observed electrons, the electron flux variations being due either to the inherent variations of the double layer or to its interaction with the micropulsations. Because of the sparcity of parameters measured so far, the models are provisional. A follow-up experiment is proposed to further investigate the problem. Author (ESA)

N78-14737# Northwestern Univ., Evanston, Ill. Dept. of Industrial Engineering and Management Sciences.

OPTIMAL EXPANSION OF FLOOD CONTROL SYSTEMS, VOLUME 1 Final Report

Thomas L. Morin and Young Soo Shin Mar. 1977 63 p refs Prepared for Ill. Univ., Urbana-Champaign

(Contract DI-14-31-0001-6014; OWRT Proj. A-079-ILL(1))

(PB-270643/0; UILU-WRC-77-0121-Vol-1; W77-10263) Avail: NTIS HC A04/MF A01 CSCL 13B

Methodologies for the planning of flood control systems of structural measures, as well as methodologies for the planning of flood control systems consisting of both structural and nonstructural measures are presented. Myopic decision rules, dynamic programming and hybrid dynamic programming/branch-and-bound algorithms were developed for capacity expansion planning under budgetary constraints. Similar methodologies are presented for capacity expansion planning with both deterministic and stochastic demand. The advantages and short-comings of the methodologies are discussed and promising directions for future research are indicated. GRA

N78-14738# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.

CATALOG OF SEISMOGRAM ARCHIVES

Dale Glover May 1977 59 p refs

(PB-272206/4; NOAA-77080207) Avail: NTIS HC A04/MF A01 CSCL 08K

Seismograms available from NGSDC are described and seismograms currently on hand are reviewed. Locations of all stations that are presently furnishing seismograms to NGSDC are delineated. GRA

N78-14739# Environmental Monitoring and Support Lab., Las Vegas, Nev. Monitoring Systems Research and Development Div.

FUSION METHOD FOR THE MEASUREMENT OF PLUTONIUM IN SOILS: SINGLE-LABORATORY EVALUATION AND INTERLABORATORY COLLABORATIVE TEST Progress Report, 1 Jan. 1974 - 30 Sep. 1976

P. B. Hahn, E. W. Bretthauer, P. B. Altringer (Bureau of Mines, Salt Lake City), and N. F. Mathews Jul. 1977 77 p refs

(PB-271965/6; EPA-600/7-77-078) Avail: NTIS HC A05/MF A01 CSCL 08L

The results of a single laboratory evaluation and an interlaboratory collaborative test of a method for measuring plutonium in soil are presented. The method employs potassium fluoride and potassium pyrosulfate fusions to decompose a 10 gram sample, barium sulfate precipitations, solvent extraction and electrodeposition to isolate the plutonium, and alpha spectrometry to measure the plutonium. Also discussed are several problem areas associated with environmental actinide analyses. GRA

N78-14740# National Center for Atmospheric Research, Boulder, Colo.

WHAT IF MANKIND WARMS THE EARTH

W. William W. Kellogg 1977 20 p refs Presented at ENVITEC Congr., Dusseldorf, 9 Feb. 1977

(AED-Conf-77-002-003; Conf-770223-2) Avail: NTIS HC A02/MF A01

There are a variety of human activities that are being pursued on such a large scale that they may influence regional and global climate. Virtually all of these activities, including the addition of carbon dioxide and particles to the atmosphere, are expected on theoretical grounds to cause an increase in mean surface temperature in the decades ahead, and by 2000 AD the total warming effect will probably be larger than any of the natural climate fluctuations during the past 1,000 years or more. It is therefore pertinent to inquire what a warmer earth might be like; and to obtain a first rough answer, mathematical models of the atmosphere, and the conditions that have been deduced for the period about 4,000 to 8,000 years ago when the earth was apparently several degrees warmer than now, are considered. At that time some areas that are now subtropical deserts received more rainfalls, and there were other areas in the middle latitudes that were drier. ERA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N78-14741 British Library Lending Div., Boston Spa (England).

BACKGROUND VARIATION IN ATMOSPHERIC CIRCULATION OVER THE NORTH ATLANTIC DURING THE PRESENT CENTURY

V. V. Lykova and A. A. Lykov [1977] 16 p refs Transl. into ENGLISH from Izv. Vses. Geos. Obshch. (Moscow), v. 108, no. 4, 1976 p 304-310

(BLLD-M-24918-(5828.4F); BLLD-Trans-1266) Avail: British Library Lending Div., Boston Spa, Engl.

Fundamental features of secular variations in atmospheric circulation over the North Atlantic were clarified in order to understand the genesis and dynamics of climate. It was found that westerly transport has weakened south of Iceland, since 1930, against secular variation. This, with the increase of meridional exchange intensity, is apparently a consequence of pressure field decrease in the region from 1930 to 1950. An increase in the intensity of the meridional component of atmospheric circulation was accompanied by an increase in the

total zonal transport. A pronounced southward shift of meridional transport from 1920 to 1950 took place in the region between Iceland and the British Isles, from western Greenland to Labrador. The increase of northerly currents was most apparent in the southeast of Greenland. Author

N78-14742 British Library Lending Div., Boston Spa (England).
LARGE-SCALE INTERACTION BETWEEN THE OCEAN AND THE ATMOSPHERE IN THE NORTH ATLANTIC
V. G. Kort [1977] 15 p refs Transl. into ENGLISH from Akad. Nauk. Okeanograf. Kom., Okeanolgiya (Moscow), v. 16, no. 4, 1976 p 565-570 In RUSSIAN and ENGLISH
(BLLD-M-24916-(5828.4F); BLLD-Trans-1286) Avail: British Library Lending Div., Boston Spa, Engl.

Consideration is given to a physical model of large scale interaction between thermodynamic processes in the North Atlantic and the atmospheric circulation. The generating mechanism of this interaction is space-time variability in the characteristics of the subpolar ocean front resulting from the transport of temperature anomalies by currents. The model describes 4 to 5 year quasiperiodic fluctuations in the circulations of atmosphere and ocean. Author

N78-14743 British Library Lending Div., Boston Spa (England).
ROCKET METEOROLOGICAL SOUNDING
G. A. Kokin [1977] 20 p refs Transl. into ENGLISH from Tr. Tsent. Aerol. Obs. (Moscow), no. 17, 1976 p 40-51 In RUSSIAN and ENGLISH
(BLLD-M-24926-(5828.4F); BLLD-Trans-1278) Avail: British Library Lending Div., Boston Spa, Engl.

Exploration of the upper atmosphere through the use of rocket sounding was discussed. The history of rocket investigations, covering 25 years, was emphasized. Specific geophysical rocket launches and their individual advantages and problems were considered for both the U.S. and the U.S.S.R. Suggestions were made for future innovations useful in the field of weather forecasting. B.L.P.

N78-14744 British Library Lending Div., Boston Spa (England).
THE STATISTICAL STRUCTURE OF THE VERTICAL PROFILES OF METEOROLOGICAL ELEMENTS IN THE TROPICAL ATLANTIC
V. D. Kaznacheyeva and T. V. Rudenkova [1977] 45 p refs Transl. into ENGLISH from Uses. Nauch.-Issled. Inst. Gidromet. Inf. Mirov. Tsent. Danny. (Moscow), v. 13, 1976 p 143-165
(BLLD-M-24919-(5828.4F); BLLD-Trans-1301) Avail: British Library Lending Div., Boston Spa, Engl.

The characteristics of the statistical structure of the meteorological elements in the tropical Atlantic were determined. Data for the calculation of the vertical profiles were taken from aerological soundings. The record of information used for calculating the statistical parameters of the vertical structure was written on magnetic tape in a pattern developed in accordance with the principles of the organization of meteorological records for statistical analysis on an electronic computer. Author

N78-14745 British Library Lending Div., Boston Spa (England).
THE RELATIVE DURATION OF SUNSHINE AS A CLOUDINESS CHARACTERISTIC
O. S. Lvova [1977] 6 p refs Transl. into ENGLISH from Ukr. Nauch.-Issled. Gidromet. Inst., Radiat. Process. Atmos. Earth's Surf. (Kiev), 1974 p 176-177 In ENGLISH and RUSSIAN
(BLLD-M-24910-(5828.4F); BLLD-Trans-1291) Avail: British Library Lending Div., Boston Spa, Engl.

The approximate computation of the relative global radiation, Q(star) is expressed in terms of the relative duration of sunshine S(star), where Q(star) = measured global radiation at the time of observation/intensity of global radiation for mean atmospheric transparency with absence of cloud at that solar elevation; S(star) = value of relative duration of sunshine (RDS) at time of observation possible RDS may serve as an informative characteristic of the state of the sky and cloud cover, and in particular that variations in Q(star) may provide a clear picture of the passage of cloud systems over the observation point. From data collected at meteorological stations throughout the U.S.S.R., calculations indicate a linear relationship between Q(star) and S(star) which is practically identical at all the given locations for the warm (snow free) season, and may be written approximately as Q(star) - 0.80 S(star) + 0.25. The standard deviation for computation by this equation comes to 0.10, which satisfies the demands for computations of a climate nature. As to the possibility of using such a method to obtain the probable values of Q(star) for particular days, it must be said that such results could only be regarded as very approximate. Author

N78-14746 British Library Lending Div., Boston Spa (England).
TEMPORAL CORRELATION FUNCTIONS OF METEOROLOGICAL FIELDS IN THE TROPICAL ATLANTIC
V. D. Kaznacheyeva and T. V. Rudenkova [1977] 21 p refs Transl. into ENGLISH from Tr., Vses. Nauchn.-Issled. Inst. Gidromet. Inform. Mirov. Tsentr Danny (Moscow), no. 13, 1976 p 166-176
(BLLD-M-24920-(5828.4F); BLLD-Trans-1302) Avail: British Library Lending Div. Boston Spa, Engl.

Results of the calculations of autocorrelation functions of meteorological fields in the tropical Atlantic are presented. Calculations were based on aerological observations made during the period of the national tropical experiment, TROPEKS-72. Author

N78-14747 British Library Lending Div., Boston Spa (England).
THE DIGITAL PROCESSING OF SCANNING RADIOMETER (SR) DATA FROM NOAA WEATHER SATELLITES AS CARRIED OUT IN THE METEOROLOGICAL INSTITUTE OF THE FREE UNIVERSITY OF BERLIN: PART 2: NOTES ON THE DIGITAL FILTERING OF SATELLITE PICTURES
Egon Hilt [1977] 8 p refs Transl. into ENGLISH from Meteorol. Abh., Inst. Meteorol. Geophys., Freie Univ. Berlin (West Germany), ser. B,6,H.1, 1976 p 1-8
(BLLD-M-24895-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

Detailed descriptions of digital filtering and recursive filtering specifically, are presented along with each method's use in on-line processing of satellite data. Author

N78-14748 British Library Lending Div., Boston Spa (England).
THE DIGITAL PROCESSING OF SCANNING RADIOMETER (SR) DATA FROM NOAA WEATHER SATELLITES AS CARRIED OUT IN THE METEOROLOGICAL INSTITUTE OF THE FREE UNIVERSITY OF BERLIN. PART 3: SOME CONSIDERATIONS IN CONNECTION WITH THE PROCESSING OF SATELLITE PICTURES AND BASED ON STATISTICAL EVIDENCE OBTAINED FROM THEM
Egon Hilt and Karsten Pobloth [1977] 13 p refs Transl. into ENGLISH from Freie Univ., Inst. Met. a. Inst. Geophys. Wissensch. Met. Abh., Neue Folge, Ser. B,6,h.2, 1976-.26 (Berlin) 13 p
(BLL-M-24894-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

Amplitude variation, amplitude difference variation, mean value, and variance are shown to be particularly useful tools in analyzing satellite imagery. With the aid of a digital computer and an interactive display system these statistical procedures are used to analyze the quality of the transfer system and to manipulate data from the NOAA 4 Satellite. J.M.S.

N78-14749 British Library Lending Div., Boston Spa (England).
THE QUASI-BIENNIAL CYCLE IN FLUCTUATIONS OF AIR PRESSURE AND TEMPERATURE ABOVE THE NORTHERN HEMISPHERE
N. I. Yakovleva [1977] 11 p refs Transl. into ENGLISH from Glav. Geof. Ors. (Leningrad), no. 380, 1976 p 63-68
(BLL-M-24940-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

Spectral analysis was accomplished for a series composed of mean monthly data from various years, with respect to one particular month. Mean monthly temperature and air pressure at the surface were analyzed. Air pressure measurements through the months of January, July, October and April during 1891 through 1971 were considered. Temperature measurements of January and July were studied through the same years. The spectral function was computed using a three angle weight function to smooth the spectrum. Author

N78-14750 British Library Lending Div., Boston Spa (England).
THE DIGITAL PROCESSING OF SCANNING RADIOMETER (SR) DATA FROM NOAA WEATHER SATELLITES AS

CARRIED OUT IN THE METEOROLOGICAL INSTITUTE OF THE FREE UNIVERSITY OF BERLIN. PART 1: LINEARISING THE SR DATA
Heiner Billing and Dirk Koslowsky [1977] 5 p refs Transl. into ENGLISH from Freie Univ., Inst., Met. u. Inst. Geophys. Wissensch., Met. Abt., Neue Folge, Ser. b, 1, H.G, 1975, Beil.74 (Berlin) 5 p
(BLL-M-24896-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

A digital picture processing procedure developed to correct the distorted scanning radiometer pictures from the NOAA satellites is decribed. The procedure is run on the PDP 11/40 in real time. Results show that even the boundary regions of the distortion-corrected picture are good enough for recognizing large-scale cloud structures. J.M.S.

N78-14751 Rice Univ., Houston, Tex.
VECTOR ELECTRIC FIELD STRUCTURE INSIDE A NEW MEXICO THUNDERCLOUD Ph.D. Thesis
Hugh Joseph Christian, Jr. 1977 129 p
Avail: Univ. Microfilms Order No. 77-19238

A balloon electric field sensor was released from Langmuir Laboratory, New Mexico, and entered an intense thundercloud on 12 August 1975. It measured the vector electric field as it ascended through the storm. It was found that the field remained relatively constant, vertical and positive from the time the balloon entered the cloud until it reached an altitude of 6.4 kilometers msl which corresponded to a temperature of -5 C. The electric field was totally horizontal by the time the balloon reached 6.7 kilometers, and the vertical component was negative above that height. From this and other information, a model for the distribution of charge within the cloud was deduced. This model is characterized by a horizontally stratified negative charge region center near the -9 degree isotherm. Dissert. Abstr.

N78-14752 Michigan Univ., Ann Arbor.
THE EVOLUTION OF STRATOSPHERIC OZONE Ph.D. Thesis
Joel Stewart Levine 1977 119 p
Avail: Univ. Microfilms Order No. 77-18061

The evolution of stratospheric ozone was investigated using a one dimensional steady state photochemical model, including nitrogen and hydrogen chemistry and eddy transport. Results were compared with calculations performed for the evolution of ozone in a pure oxygen atmosphere, using the Chapman photochemical scheme. For both models the maximum ozone column density for oxygen levels ranging from .00001 to 10 P.A.L. was found for an oxygen level of 1 P.A.L. The inclusion of nitrogen and hydrogen chemistry reduced the total ozone column density above the earth's surface for all levels of atmospheric oxygen from a decrease of 14 to 35% for oxygen levels of 1 to 10 P.A.L., respectively, to a decrease of more than three to five orders of magnitude for oxygen levels of .001 to .00001 P.A.L., respectively, compared to the Chapman scheme calculations. Dissert. Abstr.

N78-14753 New York State Univ., Albany.
THE PROPERTIES OF A VORTEX-STABILIZED DISCHARGE IN THE CURRENT RANGE OF 3 TO 300 AMPERES AND AN ESTIMATION OF THE ABILITY OF ELECTRICAL DISCHARGES TO POWER TORNADOES Ph.D. Thesis
David Clark Watkins 1977 226 p
Avail: Univ. Microfilms Order No. 77-19944

The possibility that electrical discharges produced by thunderstorms inside a tornado could be a power source for the tornado was studied with the aid of a laboratory model and theoretical calculations. The current density and ion density in the discharge were determined in the current range of 3 to 5 amperes and were those of an arc. The variations in the gradient, core diameter, current density, and ion density at the base of the vortex were shown to be the result of air flow in the boundary layer. It was shown that while a steady state discharge does not appear to be a reasonable energy source for tornadoes, the discrete stroke discharge does. It is concluded that the heat from repetitive discharges inside a tornado is a possible energy source to explain the wind speeds found in most of the more intense tornadoes. Dissert. Abstr.

N78-14754 Tulane Univ., New Orleans, La.
A STEADY VORTEX DRIVEN BY A LINE HEAT SOURCE: A POSSIBLE MODEL FOR THE TORNADO Ph.D. Thesis
Jwo-Min Chen 1974 125 p
Avail: Univ. Microfilms Order No. 77-19495

A mathematical analysis is presented of a vortex that forms about a line heat source in an atmosphere with a given constant circulation far from the heat source and the ground. The regions near the centerline of the vortex and near the ground were treated separately using boundary layer approximations. They were joined by matching boundary conditions through an intermediate inviscid region far from both the vortex centerline and the ground, and by matching the volume flow rates inward near the ground bourdary layer and upward in the core region. The effect of the ground boundary layer on the core region flow was very large and increased as viscosity decreased. The results were used to estimate the intensity of electrical discharges necessary to provide enough energy to drive a tornado. Dissert. Abstr.

N78-14755 Direction de la Meteorologie Nationale, Paris (France).
CLIMATE OF THE KERGUELEN ISLANDS AND OF THE SUBANTARCTIC ZONE OF THE INDIAN OCEAN. CLIMATOLOGY OF PORT-AUX-FRANCAIS
C. Azibane, B. Clavier, J.-L. Dujardin, V. LeTouze, and J.-F. Frigourd Jul. 1977 141 p refs In FRENCH
(MN-Mono-99) Avail: Issuing Activity

A report is presented on the general and synoptic meteorology of the southern Indian Ocean, with particular reference to the Kerguelen Islands, covering marine and atmospheric discontinuities, general circulation, and synoptic meteorology of the subantarctic zone. In addition, the statistical and dynamic climatology of Port-aux-Francais is discussed for the years 1954-1973. ESA

N78-14756*# Ecosystems International, Inc., Gambrills, Md.
WEATHER ASSESSMENT AND FORECASTING Technical Report, 1 - 30 Jun. 1977
Dec. 1977 134 p
(Contract NAS8-32408)
(NASA-CR-150468) Avail: NTIS HC A07/MF A01 CSCL 04B

Data management program activities centered around the analyses of selected far-term Office of Applications (OA) objectives, with the intent of determining if significant data-related problems would be encountered and if so what alternative solutions would be possible. Three far-term (1985 and beyond) OA objectives selected for analyses as having potential significant data problems were large-scale weather forecasting, local weather and severe storms forecasting, and global marine weather forecasting. An overview of general weather forecasting activities and their implications upon the ground based data system is provided. Selected topics were specifically oriented to the use of satellites. Author

N78-14757# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
REMOTE SENSING WIND AND WIND SHEAR SYSTEM Interim Report, Jan. 1974 - Sep. 1976
Peter A. Mandics Mar. 1977 33 p refs
(Contract DOT-FA72WAI-281)
(AD-A046275; FAA-RD-77-54) Avail: NTIS HC A03/MF A01 CSCL 04/2

The prototype development of an acoustic Doppler remote sensing system to detect low level wind shear generated by synoptic scale features such as frontal surfaces is described. The detector system measures the vertical profile of wind by determining the Doppler frequency shift of vertically transmitted acoustic signals that are scattered by small scale atmospheric inhomogeneities. Significant improvements were accomplished on the acoustic transmitter and receiver antennas, and signal processing. A conical horn reflector antenna with a 2-m diameter aperture fed by 12 high power acoustic drivers through a manifold increased the transmitted power by more than 100%. Substantial improvements were achieved in received signal to noise ratio by developing a narrow beam, off focus steered receiver antenna that is capable of tracking the upward propagating acoustic pulse. Development of new system software made all digital signal

processing and computerized system control possible. Tests of one leg of the prototype revealed that the system measured winds reliably up to a height of 600 m when surface winds did not exceed 10 m/s. Author

N78-14758# Naval Research Lab., Washington, D. C.
SANTA ANA ASSOCIATED OFFSHORE FOG: FORECASTING WITH A SEQUENTIAL MODEL M.S. Thesis
Douglas Allen Backes Sep. 1977 113 p refs
(AD-A046265; NPS-68LR77091) Avail: NTIS HC A06/MF A01 CSCL 04/2

Aircraft measurements made offshore during a coastal fog sequence by R. A. Markson are analyzed. Fog occurrence and areal extent are determined using aircraft, ship and shore station observations obtained during the Cooperative Experiment in West Coast Oceanography and Meteorology--1976 along with analyzed satellite visual and infra-red imagery. The offshore conditions are compared with those at the shore stations using selected fog indices. Photographs of special features observed are included. The offshore conditions are classified into phases by assigning limits within the specified fog indices used in the modified Leipper fog model. The sequence of observed fog events is compared to the ideal sequence. The trends in the sequence are analyzed and a general relationship between the phase sequence and the local offshore flow is indicated. The Leipper indices, the San Diego raob and the sequential fog model appear to be useful in fog prediction for the nearshore oceanic region from San Diego the Point Conception. Author (GRA)

N78-14759# Naval Postgraduate School, Monterey, Calif.
AN INVESTIGATION OF SYNOPTIC AND ASSOCIATED MESOSCALE PATTERNS LEADING TO SIGNIFICANT WEATHER DAYS AT MCMURDO STATION, ANTARCTICA M.S. Thesis
Raymond H. Godin Jun. 1977 115 p refs
(AD-A046247) Avail: NTIS HC A06/MF A01 CSCL 04/2

Defense Meteorological Satellite Program (DMSP) and National Oceanic and Atmospheric Administration satellite imagery are used to supplement conventional radiosonde and aircraft data in an investigation of synoptic and associated mesoscale weather patterns leading to significant weather at McMurdo Station and the adjacent Ross Ice Shelf. Three case studies, 8-11 January 1976, 22-25 December 1975, and 11-13 October 1973, are analyzed, with concentration on the 700 and 400 mb levels. Meridional advection associated with ridging over the Ross Ice Shelf and/or the polar plateau serves as the moisture intrusion mechanism for significant weather in each case study. Mesoscale features about the McMurdo area serve as both triggering and blocking mechanisms preceding the significant weather events. Katabatic winds associated with glacial valley warming, originating from the polar plateau near McMurdo, are detected on DMSP infrared satellite imagery. Comparisons between Fleet Numerical Weather Central's 700 mb analyses with those of the author demonstrate the inadequacy of satellite-void analyses over the sparse data ice/snow covered south polar region. GRA

N78-14760# Florida State Univ., Tallahassee. Dept. of Statistics.
TOWARD A NONPARAMETRIC COVARIANCE ANALYSIS OF A WEATHER MODIFICATION EXPERIMENT
R. J. Serfling Aug. 1977 17 p refs
(Contract N00014-76-C-0394)
(AD-A046173; FSU-Statistics-M428; ONR-122; TR-122-ONR) Avail: NTIS HC A02/MF A01 CSCL 04/2

A further analysis of the 1967-74 Santa Barbara weather modification experiment data is in progress in the Department of Statistics, Florida State University. The present report provides a nonparametric covariance analysis, of limited scope, of the Phase I experimental data. The findings tend to confirm, qualitatively, the North American Weather Consultants conclusions of a demonstrable seeding effect under selected conditions of cloud instability and cloud temperature. Quantitively, however, the present findings are more restrained. The analysis tends to suggest the need for improved experimental designs.
Author (GRA)

N78-14761# Air Force Geophysics Lab., Hanscom AFB, Mass.
SEVERE THUNDERSTORM AND TORNADO WARNING IN REAL TIME BY COLOR DISPLAY OF DOPPLER VELOCITIES Interim Report
Michael J. Kraus, Ralph J. Donaldson, Jr., and Carlton L. Bjerkaas 18 Oct. 1977 5 p refs Presented at the 10th Conf. on Severe Local Storms, Omaha, 18-21 Oct. 1977
(AD-A045964; AFGL-TR-77-0228) Avail: NTIS HC A02/MF A01 CSCL 04/2

An operational test of Doppler radar as a real-time forecasting tool took place during Spring 1977 in Oklahoma. Participating groups included National Severe Storms Laboratory, National Weather Service, Air Weather Service and Air Force Geophysics Laboratory. The AFGL color display, mated to the NSSL 10-cm Cimarron Doppler radar, provided back-up capability to the center of operations at Norman. Also, the authors provided additional interpretation of the velocity patterns depicted on the color display for the benefit of the operational meteorologists participating in the test. Experiences in real-time identification of velocity patterns characteristic of hazardous weather are summarized in this paper. Author (GRA)

N78-14762# California Univ., Livermore. Lawrence Livermore Lab.
WIND STUDIES IN COMPLEX TERRAIN
D. M. Hardy May 1977 39 p refs Presented at Amer. Wind Energy Assoc. Meeting, Boulder, Colo., 13 May 1977
(Contract W-7405-eng-48)
(UCRL-79430) Avail: NTIS HC A03/MF A01

The development and application of general methods of wind energy assessment for hilly or mountainous areas are described. The island of Oahu, Hawaii is being used as an initial study area to develop procedures useful there and in other mountainous regions. Numerical model calculations and field measurements are employed in studying the spatial and temporal variations of wind energy. Field measurement and model results show very significant wind energy spatial variations occur as a result of complex terrain. Applications of the methodology in identifying locations of wind enhancement with multi-megawatt power collection potential are described. ERA

N78-14763# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.
TEST REPORT ON THE APPLICATION OF THE LINDE FOG REMOVAL EQUIPMENT AT THE ERDING AIR BASE [ERPROBUNGSBERICHT UEBER DEN EINSATZ DER LINDE-ENTNEBELUNGSAPPARATUR AUF DEM FLIEGERHORST ERDING]
H. Willeke and F. Katheder May 1975 59 p refs In GERMAN Sponsored by Bundesamt fuer Wehrtech. u. Beschaffung
(DLR-IB-75/8) Avail: NTIS HC A04/MF A01

With the Linde apparatus atmospheric air is dried and heated. It was found that wind has the strongest influnece because it carries away the purified air masses. With a head wind or cross wind of 2 knots the apparatus is effective only for short stretches, necessitating the need for fog removal equipment at both sides of the runway. Under calm conditions a 50 m large runway can be kept free of fog over 200 to 250 meters. ESA

N78-14764# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.
PHYSICAL PARAMETERS IN CONNECTION WITH THE COOLING TOWER MEASUREMENT CAMPAIGNS [PHYSIKALISCHE GROESSEN IM ZUSAMMENHANG MIT DEN KUEHLTURMMESSKAMPAGNEN]
W. Boegel 17 Dec. 1975 29 p refs In GERMAN
(DLR-IB-553-75/15) Avail: NTIS HC A03/MF A01

The nomenclature used in a cooling tower measurement campaign was adapted to the terminology used in a VDI (Association of German Engineers) publication on a similar project, taking due account of existing norms. The meteorological and other interesting parameters of the VDI publication were tabularized together with the German, international, and WMO norms. In a second table the WMO norms on air humidity parameters are presented. ESA

N78-14765# World Meteorological Organization, Geneva (Switzerland).

WORLD WEATHER WATCH. GLOBAL OBSERVING SYSTEM - SATELLITE SUBSYSTEM: INFORMATION ON THE APPLICATION OF METEOROLOGICAL SATELLITE DATA IN ROUTINE OPERATIONS AND RESEARCH. ABSTRACTS, ANNUAL SUMMARIES, AND BIBLIOGRAPHIES
1977 185 p
(WMO-475; ISBN-92-63-10475-1) Avail: NTIS HC A09/MF A01; WMO, Geneva

Information is given on satellite data applications in routine meteorological operations and research as contained in scientific reports, articles, and books published by WMO members. The information is listed by country in the alphabetical order of the English names. ESA

N78-14766# Royal Netherlands Meteorological Inst., De Bilt.
VERIFICATION TEST OF A BK3-MODEL WITH MODIFIED MODEL CONSTANTS ON AN EXISTING DATA-SET [VERIFICATIETEST VAN EEN BK3-MODEL MET GEWIJZIGE MODELCONSTANTEN OP EEN BESTAANDE DATA-SET]
J. H. A. Bernard and J. D. Opsteegh 1977 9 p In DUTCH
(KNMI-V-289) Avail: NTIS HC A02/MF A01

In comparison with tests described earlier the constants were modified to: Cressman correction 0.4 x 10 to the minus 12th power / sq m and diffusion constant 500,000 sq m/sec. With this model 36 hours prognosis for troughs, crests, and depression nuclei in the 500 mbar plane were made, using semi-objective and objective verification methods. Results were compared with those obtained with the operational model. ESA

N78-14767# Royal Netherlands Meteorological Inst., De Bilt.
RESULTS OF AN EXPERIMENT CONCERNING THE PREDICTABILITY OF WAVES N = 3-10 IN A FIVE DAYS AVERAGE BAROTROPIC MODEL [RESULTATEN VAN EEN EXPERIMENT BETREFFENDE DE VOORSPELBAARHEID VAN DE GOLVEN N = 3-10 IN EEN 5-DAAGE GEMIDDELD BAROTROOP MODEL]
A. P. M. Baede and J. Reiff 1977 72 p refs In DUTCH; ENGLISH summary
(KNMI-WR-77-4) Avail: NTIS HC A04/MF A01

Results of the experiment, using time and space smoothed real 500 mbar fields in a simple hemispheric equivalent barotropic gridpoint model are discussed. The model is a finite difference model with fourth-order accuracy in space and second-order accuracy in time. A Cressman correction was used to avoid the fast spurious westward movement of the long waves. A nonlinear balance equation was used to obtain the stream function from the 500 mbar height field. Verification results, using the anomaly correlation coefficient c sub a and the persistency coefficient c sub p, are given. For 36 cases c sub a was larger than c sub p in all wave classes (n = 1-2, 3-5, 6-10). Only for the wave class n = 6-10 c sub a was significantly larger than c sub p at a 5% significance level. The same experiments were repeated with analyses of the Royal Netherlands Meteorological Institute (KNMI), which have a poorer quality. South of 40 deg north these analyses are very noisy and therefore extra smoothing of the initial fields was necessary. The 120 h forecasts were made with synoptic KNMI analyses where the central day of the corresponding 5-day period was taken as the initial situation. Also in this case no significant improvement of c sub a over c sub p for the waves n = 3-10 was observed. Nevertheless, the 120 h results obtained with a very simple time-averaged equivalent barotropic model on the basis of the NMC 5-day mean 500 mbar analyses are amazing. Author (ESA)

N78-14768# National Climatic Center, Asheville, N. C.
COMPARATIVE CLIMATIC DATA THROUGH 1976
Alva L. Wallis, Jr., ed. Apr. 1977 72 p
(PB-272671/9; NOAA-77090107) Avail: NTIS HC A04/MF A01 CSCL 04B

Values of climatological elements are matched for 300 National Weather Service stations in the 50 states, as well as for San Juan, P.R. and 12 Pacific islands. The stations listed include 79 of the 90 major urban areas that reported populations greater than 150,000 in the 1970 census; data are also presented for weather stations within 30 miles of the other 11 major urban areas. The data are arranged by climatic element, so that monthly and annual values can be compared for different locations in a single table. GRA

N78-14769# National Weather Service, Salt Lake City, Utah Western Region.
STATISTICAL GUIDANCE FOR THE PREDICTION OF EASTERN NORTH PACIFIC TROPICAL CYCLONE MOTION, PART 1
Charles J. Neumann and Preston W. Leftwich Aug. 1977 42 p refs
(PB-272661/0; NOAA-TM-NWS-WR-124-Pt-1; NOAA-77090109-Pt-1) Avail: NTIS HC A03/MF A01 CSCL 04B

The derivation, application and operational utility of an analog and simulated analog model for the prediction of tropical cyclone motion over the Eastern North Pacific tropical cyclone basin is documented. These two models, together with an additional statistical-synoptic model form the nucleus of a recently activated statistical prediction quidance package for use by the National Weather Service Eastern Pacific Hurricane Center located at the Weather Service Forecast Office, San Francisco, California. Testing of the two models on 1976 operational data shows that both perform well on nonrecurving storms. GRA

N78-14770# National Oceanic and Atmospheric Administration, Boulder, Colo. Weather Modification Program Office.
VERTICAL SHEAR OF THE HORIZONTAL WIND SPEED IN TROPICAL CYCLONES
John Bates Aug. 1976 26 p refs
(PB-272659/4; NOAA-TM-ERL-WMPO-39; NOAA-77090111) Avail: NTIS HC A03/MF A01

A profile from 10 to 6000 m constructed from research aircraft, buoy, and tower data is presented. These data are normalized so that different strength storms can be compared. The various wind pressure relations and gust factors are also examined, particularly in relation to flight level winds and the profile constructed herein. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N78-14771# Royal Netherlands Meteorological Inst., De Bilt.
ADOPTING QUADRATIC STREAM FUNCTIONS TO STREAM OBSERVATIONS [AANPASSEN VAN KWADRATISCHE STROOMFUNCTIES AAN STROOMWAARNEMINGEN]
S. Kruizinga 1977 12 p In DUTCH
(KNMI-V-287) Avail: NTIS HC A02/MF A01

A method to select objectively the best stream function from a given set of observations was developed. In an oceanographic investigation into residual streams in the southern part of the North Sea, a number of flow meters were installed in a relatively small area (approx. 200 sq km). The measurements from these flow meters were converted into residual streams by averaging over a tidal period. Topics discussed are statistical models, coefficient estimation, coefficient reliability, and coefficient testing. The computer program OBJECT/FITSTREAMFUNC that can be used for any problem giving rise to coupled linear regression equations is described. ESA

N78-14772# General Accounting Office, Washington, D. C. Procurement and Systems Acquisition Div.
THE SEASAT-A PROJECT: WHERE IT STANDS TODAY: NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
16 Sep. 1977 50 p
(PB-272004/3; PSAD-77-126) Avail: NTIS HC A03/MF A01 CSCL 08J

It was recommended by GAO that Congress and NASA take several actions before the experimental SEASAT-A project is expanded to an operational program. The SEASAT-A spacecraft, scheduled for launch in 1978, will measure ice fields, winds, waves, ocean currents, sea temperatures, and atmospheric water

vapor. NASA's January 1977 project cost estimate of $80.5 million excludes $12.3 million of related costs. The cost estimate is continuing to be reviewed by NASA. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

No abstracts in this category.

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N78-14773* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TISSUE MACERATING INSTRUMENT Patent
Edward F. Baehr and James E. Burnett, inventors (to NASA) Issued 6 Dec. 1977 4 p Filed 15 Apr. 1976 Supersedes N76-23837 (14 - 14, p 1836)
(NASA-Case-LEW-12668-1; US-Patent-4,061,146; US-Patent-Appl-SN-677353; US-Patent-Class-128-305) Avail: US Patent Office CSCL 06B

A surgical tissue macerating and removal tool is described which has a rotating rod with a cutting member at one end and which is disposed in a tube which is then contained in an extension of the tool handle. A frusto-conical member extends into the extension at the cutter member end of the rotating rod with its small end engaging the tube. The portion of the frusto-conical member outside of the extension forms a tissue engaging member and may be cut off at an angle to the axis of the rod to form a tissue engaging edge. Apertures are provided in the extension adjacent the frusto-concial member so that treatment fluid supplied in the annular space between the tube and the extension may flow to the operative site. An aperture is provided in the frustoconical member between the extension and the tube so that fluid may also flow into the tube where it mixes with macerated tissue being directed through an aperture in the tube to a passageway which may have suction applied to help remove macerated material.
Official Gazette of the U.S. Patent Office

N78-14774 Pennsylvania Univ., Philadelphia.
MEASUREMENT OF PASSIVE ELECTRICAL PROPERTIES OF MUSCLE: TECHNIQUES AND APPLICATIONS Ph.D. Thesis
George Carl Farnbach 1977 120 p
Avail: Univ. Microfilms Order No. 77-19845

Techniques were developed for the measurement of passive membrane properties of excitable tissue. A method was developed for the extraction of estimates of membrane resistance and membrane capacitance from the intracellularly recorded response of a single muscle fiber to a single square current pulse. This time domain analysis used a Gauss-Newton curve fitting technique to achieve a least-squares fit to the recorded response of the muscle fiber. The method is shown to give results equivalent to older methods and has the advantages of reduced experimental time requirements and an increased probability of successful measurement from each fiber penetrated. Dissert. Abstr.

N78-14775 Washington Univ., Seattle.
X-RAY PHOTOGRAMMETRIC ANALYSIS OF SKELETAL SPATIAL MOTIONS Ph.D. Thesis
Takenori Takamoto 1976 232 p
Avail: Univ. Microfilms Order No. 77-18425

X-ray images are applied to measuring skeletal spatial motions. Space position and orientation of an X-ray anode are calibrated analytically with a reference frame on which control points are attached. The Reseau method is introduced to correct X-ray image distortions analytically. The accuracy of the method is intensively investigated by a modified transit and a control frame. The method is demonstrated by analyzing patellar motion that occurs on flexion of the knee joint of a patient. Measurements are made on one patient at different time intervals after a medical operation. The stereoscopic observations of anatomical objects are studied but rather restricted applications are found. For the precise measurements of patellar spatial motions steel balls are implanted in a patient as reference points and targets.
Dissert. Abstr.

N78-14776*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
STARPAHC SYSTEMS REPORT. VOLUME 1: EXECUTIVE SUMMARY
30 Oct. 1977 46 p
(Contract NAS9-13170)
(NASA-CR-151578; LMSC-D566138-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 06E

A joint NASA and Department of Health, Education, and Welfare/Indian Health Services demonstration project entitled Space Technology Applied to Rural Papago Advanced Health Care (STARPAHC) was conducted to develop a solution for delivering quality health care to people in remote geographical areas. The STARPAHC concept verified the feasibility of telemedicine plus physician assistant - under the direction of a physician as a means of delivering quality health care. The two years of operational evaluation have provided considerable medical and engineering data which will be valuable to the designers and planners of future health care systems on earth and in space. Author

N78-14777*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
STARPAHC SYSTEMS REPORT. VOLUME 2: OPERATIONAL PERFORMANCE
30 Oct. 1977 285 p
(Contract NAS9-13170)
(NASA-CR-151579; LMSC-D566138-Vol-2) Avail: NTIS HC A13/MF A01 CSCL 06E

The Space Technology Applied to Rural Papago Advanced Health Care (STARPAHC) demonstrated the value and potential of telemedicine using physician's assistants for providing quality health care delivery to people in a remote area. Generally, the program's achievements were to: (1) establish the feasibility of the STARPAHC concept in the delivery of health care; (2) gain information for developing health care systems for future manned spacecraft; (3) determine the constraints and capabilities involved in the interaction between physicians and non-physician health care personnel; (4) determine effectiveness of the STARPAHC technique; and (5) define the additional developments that are needed and/or most valuable to improving telemedicine and its exportable potential. Author

N78-14778*# General Electric Co., Houston, Tex.
PHYSIOLOGICAL SPACECRAFT ENVIRONMENT DATA DOCUMENTATION Final Report
15 Dec. 1977 7 p
(Contract NAS9-15094)
(NASA-CR-151589; TIR-741-LSP-7019) Avail: NTIS HC A02/MF A01 CSCL 06S

The physiological limits of exposure to environmental parameters encountered during space flight was documented. The environmental limits which have been previously established were described in terms of acceptable physiological changes. The process of coordinating data and assembling the completed data book is described in this report. Author

N78-14779# Duke Univ., Durham, N. C.
THE ORIGIN OF CATARACTS IN THE LENS FROM INFRARED LASER RADIATION Annual Progress Report, 1 Sep. 1976 - 31 Aug. 1977
M. L. Wolbarsht, M. A. Orr, B. S. Yamanashi, J. S. Ziller, and I. B. C. Matheson 24 Oct. 1977 22 p refs
(Contract DAMD17-74-C-4133; DA Proj. 3E7-62772-A-813) (AD-A046165) Avail: NTIS HC A02/MF A01 CSCL 06/5

Changes in lens proteins following exposure to IR irradiation have been used to detect the earliest changes possible in cataract formation. Rat lenses maintained in organ culture have been used to determine the temperature which will initiate cataractogen-

esis. Exposures from a CW neodymium laser (1060 nm) were used to determine what energy levels are necessary to produce protein changes. These changes have been characterized by thin layer isoelectric focused electrophoresis and sodium dodecyl sulfate electrophoresis. Author (GRA)

N78-14780# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
A PROCEDURE FOR THE EVALUATION OF PHYSIOLOGICAL MEASUREMENTS [EIN VERFAHREN ZUR AUSWERTUNG PHYSIOLOGISCHER MESSUNGEN]
Ernst Hoermann 20 Apr. 1977 48 p In GERMAN
(DLR-IB-552-77/9) Avail: NTIS HC A03/MF A01

A procedure using digital computers was developed. For the digitalization an EAI 8400 hybrid computer was used and for the final evaluation a Telefunken TR440 computer. The following physiological parameters were evaluated: volume pulse (recorded with a plethysmograph at the ear-lobe), eye movements (electro opthalmogram), breathing (thermistor at mouth or nose opening), and reaction times. ESA

N78-14781# Royal Aircraft Establishment, Farnborough (England). Engineering Physics Dept.
HEAD AND NECK MOBILITY OF PILOTS MEASURED AT THE EYE
M. C. Champion and W. G. A. Port London Aeron. Res. Council 1977 33 p refs Supersedes RAE-TR-74158; ARC-36353 (ARC-R/M-3803; RAE-TR-74158; ARC-36353) Avail: NTIS HC A03/MF A01; HMSO £4.25; PHI $16.45

A study of the head and neck mobility of nine selected pilot subjects was made by measuring the movement envelope of the pilot's eye position as he craned his head and neck up, down, and from side to side. During these movements the subjects looked forward at a target board through a sight aperture. The subjects were strapped into an ejection seat instrumented to monitor harness tension, and were clothed in standard RAF summer and winter aircrew equipment assemblies. The effects of wearing a standard RAF Mark 2/3 flying helmet, and differences between movement with summer and winter flying clothing were assessed. Author (ESA)

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N78-14782 Minnesota Univ., Minneapolis.
HUMAN PERCEPTION OF MODERATE STRENGTH LOW FREQUENCY MAGNETIC FIELDS Ph.D. Thesis
Robert Dennis Tucker 1976 102 p
Avail: Univ. Microfilms Order No. 77-19068

The effects of moderate magnetic and electric fields on human subjects was investigated and a test was made to determine whether individuals deprived of auxiliary clues can detect these fields by conscious perception. A number of individuals seemed able to detect these fields even when shielded from sound and vibration. With computer feedback reinforcement, this perceptive skill was enhanced, yielding in the most responsive individuals p values as low as 10 to the -30th power against happening by pure chance. By systematic exclusion of trace clues, however, perception was worked down until even the best perceivers fell to performance levels practically those of pure chance. Other tests indicated that reported headaches symptomatic of magnetic fields occurred even when no field was present. Dissert. Abstr.

N78-14783# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Hamburg (West Germany). Inst. fuer Flugmedizin.
PSYCHOLOGICAL SELECTION OF APPLICATION FOR FLIGHT MECHANIC TRAINING [DIE PSYCHOLOGISCHE AUSWAHL VON BEWERBERN FUER DIE AUSBILDUNG ZUM FLUGINGENIEUR]
H. Kirsch, S. Fichtbauer, and M. Nordhausen 1977 32 p refs In GERMAN
(DLR-IB-355-77/03) Avail: NTIS HC A03/MF A01

A battery of tests is described for the selection of applicants. A short description of the psychological contents of each test method is given. The correlation of test results with selection is outlined. ESA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N78-14784* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
IODINE GENERATOR FOR RECLAIMED WATER PURIFICATION Patent
Richard A. Wynveen (Life Systems, Inc., Beachwood, Ohio), James D. Powell (Life Systems, Inc., Beachwood, Ohio), and Franz H. Schubert, inventors (to NASA) (Life Systems, Inc., Beachwood, Ohio) Issued 6 Dec. 1977 5 p Filed 25 Apr. 1975 Supersedes N75-25594 (13 - 16, p 2021) Sponsored by NASA
(NASA-Case-MSC-14632-1; US-Patent-4,061,570; US-Patent-Appl-SN-571459; US-Patent-Class-210-96M; US-Patent-Class-210-192; US-Patent-Class-204-180P; US-Patent-Class-204-301; US-Patent-Class-23-253A) Avail: US Patent Office CSCL 06K

The system disclosed is for controlling the iodine level in a water supply in a spacecraft. It includes an iodine accumulator which stores crystalline iodine, an electrochemical valve to control the input of iodine to the drinking water and an iodine dispenser. A pump dispenses fluid through the iodine dispenser and an iodine sensor to a potable water tank storage. The iodine sensor electronically detects the iodine level in the water, and through electronic means produces a correction current control. The correction current control operates the electro-chemical iodine valve to release iodine from the iodine accumulator into the iodine dispenser. Official Gazette of the U.S. Patent Office

N78-14785 Tulane Univ., New Orleans, La.
MODELING AND CONTROL OF THE HUMAN HEAD-NECK RESPONSE UNDER IMPACT ACCELERATION Ph.D. Thesis
Maher Labib Rouziek 1975 115 p
Avail: Univ. Microfilms Order No. 77-19508

Analytical and computer models of the human head-neck system and a controller design procedure to control the movements of the head-neck high accelerations are presented. In model parameter optimization two different methods are used. Using the discrete gradient technique, the shape of any nonlinear relation must be determined prior to any parameter optimization run. The adaptive technique is superior to the gradient technique in three respects: (1) it allows the model to behave almost exactly like the system which is not always possible with the gradient technique, (2) any nonlinear relations are automatically generated by the adaptive loop to make the mode behave like the system, and (3) it is a continuous single run technique while the gradient technique is iterative. The controller design forces the responses of the human head-neck to be contained within certain prespecified bounds even in the presence of high impact acceleration. Dissert. Abstr.

N78-14786*# Wintec Corp., Los Angeles, Calif.
[DESIGN OF HIGH PRESSURE OXYGEN FILTER FOR EXTRAVEHICULAR ACTIVITY LIFE SUPPORT SYSTEM, VOLUME 1] Final Report
B. A. Wilson 30 Nov. 1977 206 p refs 2 Vol.
(Contract NAS9-14466)
(NASA-CR-151571; TR-415-Vol-1) Avail: NTIS HC A10/MF A01 CSCL 06K

The experience of the National Aeronautics and Space Administration (NASA) with extravehicular activity life support emergency oxygen supply subsystems has shown a large number of problems associated with particulate contamination. These problems have resulted in failures of high pressure oxygen component sealing surfaces. A high pressure oxygen filter was designed which would (a) control the particulate contamination

level in the oxygen system to a five-micron glass bead rating, ten-micron absolute condition and (b) withstand the dynamic shock condition resulting from the sudden opening of 8000 psi oxygen system shutoff valve. Results of the following program tasks are reported: (1) contaminant source identification tests, (2) dynamic system tests, (3) high pressure oxygen filter concept evaluation, (4) design, (5) fabrication, (6) test, and (7) application demonstration. Author

N78-14787*# Wintec Corp., Los Angeles, Calif.
[DESIGN OF HIGH PRESSURE OXYGEN FILTER FOR EXTRAVEHICULAR ACTIVITY LIFE SUPPORT SYSTEM. VOLUME 2: TEST DATA] Final Report
B. A. Wilson 30 Nov. 1977 281 p refs 2 Vol.
(Contract NAS9-14466)
(NASA-CR-151572; TR-415-Vol-2) Avail: NTIS HC A13/MF A01 CSCL 06K
For abstract, see N78-14786.

N78-14788# IBM Federal Systems Div., Owego, N. Y.
PROGRAM DOCUMENTATION FOR THE HEAD SWITCHING SOFTWARE PACKAGE
J. J. Miller, Jr. Jun. 1977 114 p
(Contract F33615-75-C-5152)
(AD-A046175; AMRL-TR-77-41; HESS-77-3) Avail: NTIS HC A06/MF A01 CSCL 05/8

The Head Switching Software Package is a system of programs which provide the capability to study item selection and switch activation by an operator's head line of sight. Data is gathered on the speed and accuracy of accomplishing discrete pointing tasks with the helmet mounted sight and stored on magnetic tape for subsequent data analysis. The programs were written for an IBM System/370, Model 155 computer running under the standard MFT version of the Operating System. Assembler language was used in coding the executive program and FORTRAN was used for the subroutine programs. The IBM System/370 Operating System Graphic Subroutine Package (GSP) for FORTRAN 4 was utilized for the graphic software support. Author (GRA)

N78-14789# Naval Air Test Center, Patuxent River, Md.
ANALYSIS OF FLIGHT CLOTHING EFFECTS ON AIRCREW STATION GEOMETRY
H. G. Gregoire 19 Oct. 1977 17 p refs
(AD-A046260; NATC-TM-77-1-SY) Avail: NTIS HC A02/MF A01 CSCL 15/5

The purpose of this evaluation was to quantify the effect of flight clothing and equipment on pilot accommodation in ejection seat tactical aircraft. The data derived from this evaluation are applicable to any similarly dressed and equipped aircrewman in tactical or training aircraft. Subjects selected for the study represented the typical range of aircrewmen body sizes within the Naval aviation population. Comparative anthropometric measurements were made between three conditions: (a) unclad, (b) wearing summer flight gear, and (c) wearing winter flight gear. Volumetric quantifications of increased bulk, as well as angular quantifications of decreased mobility, were accomplished. The data describe significant limitations in cockpit reach capability and torso movement as a function of summer and winter flight clothing and equipment. The most restrictive item worn was the CWU-33P anti-exposure garment. An all-encompassing reengineering of the total system of flight clothing and equipment should be undertaken to lighten the weight and reduce the mobility-restricting bulk of such items. When designing crew station geometry and locations of controls and displays, designers should incorporate the maximum available data describing reduction in anthropometric mobility and increase in anthropometric volume, resulting from flight clothing and equipment worn on the body. GRA

N78-14790# Michigan Univ., Ann Arbor. Highway Safety Research Inst.
VALIDATION STUDIES FOR HEAD IMPACT INJURY MODEL Final Report, 1 Jul. 1973 - 31 Aug. 1975
R. L. Stalnaker, N. M. Alem, and J. B. Benson Sep. 1977 541 p refs
(Contract DOT-HS-031-3-749)
(PB-272285/8; UM-HSRI-76-14; DOT-HS-802-566) Avail: NTIS HC A23/MF A01 CSCL 13F

Experiments were performed involving the heads of subhuman primates and fresh unembalmed cadavers with sufficient precision and reliability so that a validation of an analytical model can be made for the impact situation. Brain injury mechanisms were determined in the primate test from the pathology and engineering data obtained from the experiments. The static load-deflection response, and the resulting static principal strains on the skulls of two monkeys and one human cadaver, are reported. Thirty-nine live primate head impacts and two human cadaver head impacts are reported in the texts. Techniques for measuring epidural pressure during impact, strains on the skull, and placement of six accelerometers on the skull were developed. GRA

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

N78-14791# Committee on Science and Technology (U. S. House).
POSSIBILITY OF INTELLIGENT LIFE ELSEWHERE IN THE UNIVERSE
Washington GPO 1977 131 p refs Rept. for Comm. on Sci. and Technol., 95th Congr., 1st Sess., Oct. 1977 Revised Prepared by Library of Congr., Congressional Res. Service
(GPO-98-185) Avail: SOD

The possibility is discussed of life existing beyond the earth. Efforts of the U.S. space program to receive signals from extraterrestrial beings or to contact such beings are outlined, including that of the NASA Study Group for the Search for Extraterrestrial Intelligence. J.H.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering*.

N78-14792 Southern Methodist Univ., Dallas, Tex.
SEQUENTIAL ALGORITHMS FOR ENHANCEMENT AND RESTORATION OF NOISY IMAGES Ph.D. Thesis
H. R. Keshavan 1977 123 p
Avail: Univ. Microfilms Order No. 77-19158

Recursive techniques are developed for enhancement of images using only the noisy data. Particular attention is given to the development of recursive techniques which can be easily implemented on a mini-computer. Recursive techniques developed include the use of noninterpolative (Markov) models and interpolative models (non-causal) in one dimension as well as two-dimensional interpolative models for the image data. Suitable schemes to identify the parameters of the model are combined with estimation schemes to recover the image data from noisy observations. Several examples are presented to indicate the performance of the various techniques. The processed images include Phantom images, the Girl image, the Moonscape image and several biomedical images of heart scans and gated blood pool scans. Dissert. Abstr.

N78-14793 Louisiana Tech Univ., Ruston.
REGISTER-TRANSFER LEVEL SIMULATION OF MICRO-PROGRAM CONTROLLED PROCESSORS AS A BASIS FOR EVALUATING DIGITAL COMPUTER SYSTEM DESIGNS Ph.D. Thesis
Robert Rainey Little 1977 95 p
Avail: Univ. Microfilms Order No. 77-19816

Microprogrammed control of digital processors, emphasizing the logical equivalence of hardware and software and the hierarchical levels of structure in digital systems, provides a regular, flexible environment for investigation of design alternatives. A method is developed that combines the concepts of microprogrammed control and register-transfer level simulation on a general purpose digital computer to provide a means for conducting computer system design experiments. A review of literature related to the topic, a discussion of microprogrammed processor control and an explanation of the method are presented. Experiments conducted to demonstrate application of the method are described, and conclusions are drawn from those experiments, with recommendations for further study. Dissert. Abstr.

N78-14794 Rice Univ., Houston, Tex.
A MODULAR MULTIPROCESSOR ARCHITECTURE FOR ARRAY PROCESSING Ph.D. Thesis
Sudhir Raman Ahuja 1977 248 p
Avail: Univ. Microfilms Order No. 77-19230

A multiprocessor architecture is presented which combines the versatility of conventional multiprocessor systems and the low cost and simplicity of pipelined processors. The system presented is intended to be used as the vector processing section of a general purpose computer or a group of such computers. The system can also be used as a stand alone specialized processor for certain special applications in Signal Processing, Seismic Data Processing, and other such fields requiring large vector computations. Techniques are provided for designing a fast vector processing system using a number of slow microprocessors to achieve a performance comparable to that of large vector computers. It is shown that besides the common vector operations the system is well suited for executing some special parallel algorithms for Fast Fourier Transform, polynomial evaluation and linear recurrence problems. Dissert. Abstr.

N78-14795 Michigan Univ., Ann Arbor.
A METHODOLOGY FOR DATA BASE DESIGN IN A PAGING ENVIRONMENT Ph.D. Thesis
Elias Berelian 1977 297 p
Avail: Univ. Microfilms Order No. 77-17950

A methodology for partially automating the design of the logical structure of a paged data base is described. The approach is to map a high level description of user requirements in terms of individual data items and binary relations into a set of record structures and record relationships. Intra- and inter-record structures generated by this design method conform to the CODASYL Data Base Task Group specifications. The data base is assumed to be accessed in a paging environment. The mapping is such that the resulting data base structure is optimal, over a certain class of DBTG structures, in the sense that it produces a minimum expected number of page faults for a prespecified set of user activities, subject to storage and security constraints. An example application was constructed and the results of applying the data base design methodology to the example application have been studied. Dissert. Abstr.

N78-14796 Arizona State Univ., Tempe.
AN EMPIRICAL EVALUATION OF ANALYTICAL COMPUTER SYSTEM PERFORMANCE MODELS Ph.D. Thesis
Matthew Allen Diethelm 1977 259 p
Avail: Univ. Microfilms Order No. 77-17865

The models include both deterministic and stochastic forms although the emphasis is on models based on network queueing theory. A unique model form which more fully represents a mass storage subsystem within the total system model structure is developed and evaluated. The evaluation of the models is based upon the measurements made during a group of controlled experiments with varying computer system configurations and workloads. The experiments and the resulting measurement data are described along with the synthesis of inputs for the models from the measurements data. The evaluation of the models is presented in specific terms as to the ability of each model to predict the computer system performing for the workloads and configurations defined and measured in the experiments. The evaluation quantitatively demonstrates the usefulness of models based on network queueing theory and clearly indicates the particular benefit of the model form with a more complete representation of the mass storage configuration. Dissert. Abstr.

N78-14797 Cornell Univ., Ithaca, N. Y.
DESIGN OF A USER INTERFACE FOR A RELATIONAL DATA BASE Ph.D. Thesis
Eric Krumholz Clemons 1976 225 p
Avail: Univ. Microfilms Order No. 77-18864

An interface is proposed between user data processing programs (UDPP) and a relational data base management system (RDBMS). A user schema facility for a relational data base was developed. Its principal advantage over more conventional data base systems was its structural simplicity, permitting mathematical definition of all retrieval operators, rigorous development of update properties and the greatest possible generality of supported queries. However, the simplicity of supported structures was also the major limitation of the relational model: a single hierarchically structured record from a COBOL-type file may correspond to numerous tuples stored in several normal form relations. Reconstruction of the original record was the user's responsibility: the required tuples must be identified for retrieval on the basis of content, and their data combined and reformatted as necessary. Dissert. Abstr.

N78-14798 Rice Univ., Houston, Tex.
SEQUENTIAL PROCEDURES AND DISTANCE MEASURES IN DATA PROCESSING Ph.D. Thesis
Robert Yuan-Shih Li 1977 173 p
Avail: Univ. Microfilms Order No. 77-19273

The sequential decision procedure is formulated for various degrees of statistical knowledge under two simple hypotheses, H0 and H1. Conditions under which the optimal decision thresholds are unique are studied for the case of two costly data clusters. The optimality criterion depends on the statistical model under consideration. The procedure given is for finite clusters, and is therefore constrained to terminate. For this termination requirement, a threshold is incorporated. Several distance measures are examined and their use in feature selection illustrated. Distances that involve penalty functions or distortion measures are included. Linear transformations of a data vector to a scalar using the Bhattacharyya distance as the criterion functional for Gaussian distributions, are considered in detail. An algorithm amenable to parallel processing procedures is offered. Constrained linear transformations are described and derived for sequential data reduction procedures. Dissert. Abstr.

N78-14799 Tulane Univ., New Orleans, La.
AUTOMATED MODELING OF DYNAMIC SYSTEMS USING HYBRID COMPUTER OPTIMIZATION TECHNIQUES Ph.D. Thesis
Ming Hsing Kuo 1970 172 p
Avail: Univ. Microfilms Order No. 77-19505

The existing parameter optimization techniques are extended to develop computer-aided design methods for the systematic solution of general system modeling problems. Justification for the use of the hybrid computer for solving this type of problem was based upon the characteristic feature of the hybrid computer in which it combines the high solution speed of the analog computer and the flexible programmed control and decision-making capabilities of the digital computer. As a result of this investigation, systematic techniques of searching for the optimum model of a dynamic system by experimental means are available. Because of the feature of the parallel operation of the analog computer, hybrid computer techniques provide a high-speed approach without appreciably increasing computer time for the modeling of high order systems. The computational results make immediately available to the designer a system model constructed of analog computer elements. Physical realization of the computational results is ensured by the modeling techniques developed. Dissert. Abstr.

N78-14800# National Bureau of Standards, Washington, D. C.
COMPUTER SCIENCE AND TECHNOLOGY

Dennis M. Conti and Josephine L. Walkowicz Sep. 1977 245 p Presented at 13th Computer Performance Evaluation Users Group, New Orleans, 11-14 October 1977
(PB-272072/0; LCCN-77-600040; NBS-SP-500-18) Avail: NTIS HC A11/MF A01 CSCL 09B

Some of the following topics were discussed and described. Functional Workload Characteristics and Computer Response Time in the Design of On-line Systems; Functional Workload Characterization; Some results on the Clustering Approach To Workload Modelling; Workload Characterization and Performance Measurement for a CDC Cyber 74 Computer System; Selection of ADPS for The Air Force Academy-A Case Study; Validation--All Important in Benchmarking; Determination of Nonsteady State Conditions in Performance Measurement Runs and Capturing Terminal Traffic Using a Hardware Monitor; A New Tool For Measuring Response Time. GRA

N78-14801# Ohio State Univ., Columbus. Computer and Information Science Research Center.
A NATURAL LANGUAGE GRAPHICS SYSTEM
David C. Brown and Stan C. Kwasny Jun. 1977 70 p refs
(Grant AF-AFOSR-2351-72; AF Proj. 2304)
(AD-A045946; OSU-CISRC-TR-77-8; AFOSR-77-1229TR) Avail: NTIS HC A04/MF A01 CSCL 09/2

This report describes an experimental system for drawing simple pictures on a computer graphics terminal using natural language input. The system is capable of drawing lines, points, and circles on command from the user, as well as answering questions about system capabilities and objects on the screen. Erasures are also permitted. Language input can be embellished with touches to convey positional information. The system was designed and implemented by the authors during Summer 1976, was written in LISP 1.6, runs in about 40K words on a DECSystem-10 computer, and displays pictures on an ag60 Plasma Panel. The system was implemented to test out ideas on system organization, to establish the viability of combining language and graphics, and to experiment with appropriate A.I. techniques. GRA

N78-14802# Rensselaer Polytechnic Inst., Troy, N. Y. Computer Research Lab.
QUADRAW USER MANUAL
Michael Potmesil Jun. 1977 77 p refs
(Grant AF-AFOSR-2937-76; AF Proj. 2304)
(AD-A046056; CRL-53; AFOSR-77-1243TR) Avail: NTIS HC A05/MF A01 CSCL 09/2

This report is a user manual for the program QUADRAW which draws visible-line-projection pictures of objects bounded by sections of quadric surfaces. The report describes three versions of the program, one each for the CDC 6600, Univac 1110 and IBM System/360-370 computers. It also provides the necessary documentation to permit one to modify the program for any other computer. Author (GRA)

N78-14803# National Technical Information Service, Springfield, Va.
COMPUTER SCIENCE AND TECHNOLOGY: DOCUMENTATION OF COMPUTER PROGRAMS AND AUTOMATED DATA SYSTEMS SYMPOSIUM Final Report
Mitchell A. Krasny, ed. Jul. 1977 70 p refs Symp. held at Gaithersburg, Md., 12 Oct. 1976 Sponsored jointly by NBS, Civil Serv. Comm., HEW and USGS
(PB-270597/8; NBS-SP-500-15; LC-77-608169) Avail: NTIS HC A04/MF A01 CSCL 09B

When and how to apply government-wide guidelines in developing standards and operational documentation of automated data systems is addressed. GRA

N78-14804# General Accounting Office, Washington, D. C. Logistics and Communications Div.
PLANNING FOR SOURCE DATA AUTOMATION IN GOVERNMENT INDUSTRIAL ACTIVITIES--COORDINATION NEEDED: NATIONAL CENTER FOR PRODUCTIVITY AND QUALITY OF WORKING LIFE. DEPARTMENT OF DEFENSE
23 Sep. 1977 38 p refs
(PB-272024/1; LCD-77-441) Avail: NTIS HC A03/MF A01 CSCL 09B

'Source data automation' (SDA) is a term used to describe various means of collecting data about an event in computer readable form at the point and time of the event's occurrence. The use of SDA in the industrial environment because of the significant investment and cost of operating industrial facilities and the increasing need for better and more accurate data to manage the facilities is discussed. Several successful service sector applications are included. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N78-14805 Stanford Univ., Calif.
EMPIRICAL ESTIMATES OF PROGRAM ENTROPY Ph.D. Thesis
Richard Eric Sweet 1977 168 p
Avail: Univ. Microfilms Order No. 77-18254

An attempt is made to measure entropy, the average information content of programs. A collection of 114 MESA programs, comprising approximately a million characters of source text, is analyzed. For analysis purposes, the programs are represented by trees, obtained by taking the parse trees from the compiler before the code generation pass, and merging some of the symbol table information into them. A new definition is given for a Markov source where the concept of 'previous' is defined in terms of the tree structure, and this definition is used to model the MESA program source. The entropy estimates for these Markov models vary from 4.8 bits per tree node, for a model assuming statistical independence of the nodes, to 1.7 bits, assuming dependencies of each node on its grandfather, father, and elder brother. These numbers compare with an approximate 10 bits per node required for a naive encoding, and an equivalent of 3.2 bits per node of code generated by the existing compiler. Dissert. Abstr.

N78-14806 California Univ., Los Angeles.
A DESIGN STUDY OF A SHARED-RESOURCE ARRAY PROCESSING SYSTEM Ph.D. Thesis
Alexander Thomasians 1977 491 p
Avail: Univ. Microfilms Order No. 77-19650

The Shared Computing Resource (SCR) is described as a shared-resource, high-capacity array processing system having a high level of continuous availability. High computational capacity is achieved by providing arrays of pipelined arithmetic processors and address generators. The interconnection network is designed to allow dynamic reconfiguration of SCR units according to the data-flow graph of designated computations. Dynamic allocation of tasks in the context of a gracefully degradable system guarantees a high level of continuous availability. The following issues regarding the SCR system are considered: (1) The programmability issue is treated by implementing vector and matrix operations in the system. (2) The resource utilization issue of the SCR system is dealt with by modeling it as a team-service queueing system, where each task requires multiple processors for its execution. (3) Various design tradeoffs which are expected to arise in the implementation of the SCR system are presented. Dissert. Abstr.

N78-14807 Michigan Univ., Ann Arbor.
PROVING PROGRAMS CORRECT USING ABSTRACT, HIGH-LEVEL LOGIC Ph.D. Thesis
Allan Mason Stavely 1977 124 p
Avail: Univ. Microfilms Order No. 77-18126

An attempt is made to simplify the task of proving programs correct, borrowing ideas from the field of software engineering such as modularity, abstraction, and modeling. Proofs of correctness of modular programs are treated in detail, including correctness proofs of programs containing procedure definitions and calls. The use of predicate calculus for specifying a program's logic in abstract, high-level terms is advocated, and the applicability of the general predicate calculus and one particular decidable version (the monadic second-order predicate calculus with successor) is discussed. For programs which are too large or

complex to analyze directly, the technique of modeling is presented: one would model such a program with a smaller and simpler program for purposes of analysis, and from the analysis infer properties of the original program. Dissert. Abstr.

N78-14808 Washington State Univ., Pullman.
GRAMMATICAL INFERENCE BY CONSTRUCTIVE METHOD Ph.D. Thesis
Jiunn-I Liou 1977 153 p
Avail: Univ. Microfilms Order No. 77-18508

A grammatical inference problem is investigated in which constructive methods for inferring finite-state and Chomsky normal form p-grammars from a p-sample are developed. An heuristic approach to grammatical inference is taken. Complexity measures and acceptance criterion are used in selecting a grammar. The solution p-grammar for a p-sample is defined as the p-grammar which has the least complexity and generates an acceptable language. A procedure for analyzing sample structure is proposed. Five dissimilarity measures based on the minimal cost of a sequence of edit operations (insertion, deletion, change) are defined and discussed. Techniques used as tools for the development of constructive methods are then presented. All techniques are integrated into constructive methods for the inference of finite-state and Chomsky normal form p-grammars. Dissert. Abstr.

N78-14809 Rice Univ., Houston, Tex.
GLOBAL DATA FLOW ALGORITHMS AND THEIR IMPLEMENTATIONS Ph.D. Thesis
Jayashree Ramanathan 1977 163 p
Avail: Univ. Microfilms Order No. 77-19286

A discussion is given of two problems in the area of automatic implementation of optimizing translators. First, attribute grammars are introduced and developed as an implementation tool. Examples, using this tool, are given for implementing the various optimizing functions of a translator. Second, optimization problems based on reducible flow graph models of programs are studied with a view toward efficient implementation using the above tool. An almost linear algorithm is presented for forward global data flow problems and an O(e log n) algorithm is given for backward global data flow problems. (Here n is the number of nodes and e the number of edges in the reducible flow graph being analyzed). Although similar data manipulation techniques are used in both these algorithms, it is found that the backward flow algorithm is less efficient than the forward flow algorithm. The properties of these two types of problems which imply the distinct bounds mentioned above are identified. Dissert. Abstr.

N78-14810 Pennsylvania Univ., Philadelphia.
AUTOMATIC TEST PROGRAM GENERATION Ph.D. Thesis
Yung Ko Chang 1977 422 p
Avail: Univ. Microfilms Order No. 77-19832

A test description language called NOPAL in which a user may describe diagnostic tests, and a software system which automatically generates test programs for a computer-control automatic test equipment based on the descriptions of tests is presented. The software system called the NOPAL Processor consists of three major components: syntax analysis, optimization and sequencing of tests, and code generation. The Processor accepts as input the tests specified in NOPAL, performs syntax analysis, and constructs a directed graph. The Processor proceeds to check for consistency, completeness, and ambiguity in the supplied descriptions. The execution sequence of the tests is then optimized by means of several sequencing strategies which include efficiency in fault isolation and stimuli application. Finally, the Processor produces as output an efficient program in a high level test equipment programming language called OPAL. Dissert. Abstr.

N78-14811 Rice Univ., Houston, Tex.
ATTRIBUTED GRAMMAR MODELS FOR DATA FLOW ANALYSIS Ph.D. Thesis
Rodney Wayne Farrow 1977 119 p
Avail: Univ. Microfilms Order No. 77-19248

Global data flow analysis for compiler optimization can be viewed as a particular instance of the more general problem of computing the transitive closure of a labelled, directed graph. There are several published algorithms for efficiently solving such problems on reducible program flow graphs. Three of them, [C],[U],[GW], are examined and compared. Similarities are noted between these algorithms and the attribute grammar method of [Kn]. Several graph grammars for reducible graphs are discussed. One of these graph grammars is augmented with attributes and semantic functions to solve global data flow analysis problems. Different algorithms will result from this approach, depending on how the attributes and semantic functions are implemented. Four different such implementations are presented. Three of these are shown to yield algorithms which are similar to the published algorithms which were first discussed. Dissert. Abstr.

N78-14812# Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).
A SIMULATOR FOR THE EAI-640 DIGITAL COMPUTING SYSTEM M.S. Thesis [UM SIMULADOR PARA O SISTEMA DIGITAL EAI-640]
Alberto F. Maranhao May 1977 204 p refs in PORTUGUESE
(INPE-1033-TPT/053) Avail: NTIS HC A10/MF A01

A simulator was developed for a third generation binary computer which provides the user with an outstanding, general purpose, computing capability and includes flexible input/output and interrupt features. The simulator was implemented in the Burroughs B6700 computing system and makes possible a virtual expansion of the real system configuration, such as peripheral devices and main storage, providing also debugging and diagnostic facilities. Author

N78-14813# Massachusetts Univ., Amherst.
DEVELOPMENT OF QUALITY LANGUAGES Final Report, 1 Jun. 1974 - 15 Oct. 1977
Henry F. Ledgard Oct. 1977 11 p
(Grants DAHC04-74-G-0139; DAHC04-75-G-0173)
(AD-A045900; ARO-12246.5-M) Avail: NTIS HC A02/MF A01 CSCL 09/2

Over the past decade the computer software area has faced severe problems over the quality of software. Resulting systems have often been plagued with poor performance, errors, and frequent expensive modifications. The present research was directed at one key element in the production of software -- the programming language. Three somewhat overlapping approaches were explored: (1) the development of desired properties in languages; (2) the development of new definition approaches and clarification of existing approaches; and (3) The emerging importance of the role of human factors in language design. GRA

N78-14814# Army Armament Research and Development Command, Dover, N. J. Management Information Systems Directorate.
THE BOOK OF CLYDE WITH A TORQUEING CHAPTER Final Report
Robert I. Isakower and Robert E. Barnas Oct. 1977 174 p refs
(AD-A046155; MISD-UM-77-3) Avail: NTIS HC A08/MF A01 CSCL 09/2

CLYDE is a computer language for your differential equations. It provides numerical solutions to an important class of second order elliptic partial differential equations (Laplace and Poisson) which appear in almost every branch of applied mechanics: governing the solutions to design problems in heat conduction, stress concentration, and potential fields (electric, magnetic, electrostatic, gravitation, irrotational fluid flow, etc..). There are three versions of CLYDE. This document describes the capabilities of the CDC 6000/TEKTRONIX 4014 storage tube graphics version (CLYDE-TEK) and the batch version (CLYDE-B) and also serves as a preliminary user's manual. An earlier version (CLYDE-274), written for the CDC 6500/1700/274 refresh graphics facility, is described in MISD Information Report 73-1, January 1973, and includes the extension of the solution to the fourth order stress analysis equation for flat plates. All CLYDE versions were written for CDC 6000 host computers under the SCOPE operating system with overlay structures. Two applications covered in detail in this document are steady state heat conduction and the membrane or soap film analogy of torsion of bars and shafts. Author (GRA)

N78-14815# Federal COBOL Compiler Testing Service, Washington, D. C.
BURROUGHS B7700 FORTRAN II-9
1977 17 p
(AD-A046080; FCVS66-VSR-250) Avail: NTIS HC A02/MF A01 CSCL 09/2

This Validation Summary Report (VSR) for the Burroughs B7700 FORTRAN Compiler Version 2.9 (MCP Version 2.9) provides a consolidated summary of the results obtained from the validation of the subject compiler against the FORTRAN Standard (X3.9-1966). The VSR is made up of several sections showing the discrepancies found. These include an overview of the validation which lists all categories of discrepancies by chapter within X3.9-1966. Author (GRA)

N78-14816# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.
PAGIO - A SOFTWARE PACKAGE FOR HANDLING PAGED DATA SETS
E. Schrem 1976 49 p refs
(ISD-198) Avail: NTIS HC A03/MF A01

PAGIO is a machine-dependent software package that provides FORTRAN callable subroutines for handling paged data sets on direct access backing storage. It is the basic tool for data transfer in DRS (ASKA/MIDAS), DVS, and SILO. PAGIO operations include file operations; create new file; open permanent file; close permanent file; page operations; write page; and read page. Additional specifications are error handling; O-file handling; internal control blocks; and functional restrictions. Implementation of PAGIO on CDC 6600, CYBER 174, and UNIVAC 1100 is described. Author (ESA)

62 COMPUTER SYSTEMS

Includes computer networks.

N78-14817 State Univ. of New York, Stony Brook.
STATE SPACE APPROACH TO TWO DIMENSIONAL RECURSIVE FILTERING Ph.D. Thesis
Chang-Soo Koo 1977 87 p
Avail: Univ. Microfilms Order No. 77-20037

An algorithm is developed to compute the characteristic polynomial and the inverse of the system matrix of a special dynamical equation. Similar to the temporal case, the algorithm is computationally faster than Cramer's rule. It is shown by example that the concepts of observability and controllability, proposed by Roesser, are inadequate and inconsistent. Modified concepts of observability and controllability are introduced. Duality relations are also discussed. It is shown that an arbitrary two dimensional discrete transfer function may be realized by a modified form of the Roesser state model requiring smaller shift registers than any existing realizations. In addition, it is shown that any transfer function whose numerator is separable always has a minimal realization. Also the problem of the minimal realization is studied. Dissert. Abstr.

N78-14818 Michigan Univ., Ann Arbor.
PERFORMANCE PREDICTION IN AN OPERATING SYSTEM DESIGN METHODOLOGY Ph.D. Thesis
John Winston Sanguinetti 1977 273 p
Avail: Univ. Microfilms Order No. 77-18110

The design methodology itself can be characterized as top-down and iterative. It is top-down in the sense that the design description is initially stated in very general terms and then elaborated until the system has been completely described. The design vocabulary chosen is derived from the Program Process Modeling Language, which explicitly describes the interprocess communication activity, but algorithms internal to a process may be abstracted. The elaboration process consists of replacing these abstract descriptions with detailed descriptions in the form of statements in a normal sequential programming language. When the elaboration process is done, the system design description is itself the system implementation. Performance prediction is done both analytically (for high level system descriptions) and by simulation. Finally, the limits of the applicability of the design methodology are explored. Dissert. Abstr.

N78-14819 Case Western Reserve Univ., Cleveland, Ohio.
A CASE STUDY OF THE IBM OS/VS1 OPERATING SYSTEM Ph.D. Thesis
Michael Anthony Pechura 1977 157 p
Avail: Univ. Microfilms Order No. 77-18839

Measurements are provided that describe the workload applied to the system in terms of jobs and their characteristics, the use of time by the operating system and user programs, the use of supervisor facilities, and the I/O usage and flow through the system. In most cases, the results are presented as rates normalized by the time required to execute one million instructions on the particular model of machine used in the study. This allows easy and accurate comparison to other machines and operating systems. Information about the internal structure of the operating system is included to help explain the values obtained. Dissert. Abstr.

N78-14820# California Univ., Berkeley. Lawrence Berkeley Lab.
PROCEEDINGS OF THE SECOND BERKELEY WORKSHOP ON DISTRIBUTED DATA MANAGEMENT AND COMPUTER NETWORKS
1977 267 p refs Presented at 2d Workshop on Distributed Data Management and Computer Networks, Berkeley, Calif., 25 May 1977
(Contract W-7405-eng-48)
(LBL-6416; Conf-770521) Avail: NTIS HC A12/MF A01

Topics covered include: overview of computer network and distributed database problems; design of distributed database systems; protocols; currency control; data semantics; and optimization models for networks. Two papers from the conference have already been indexed, and may be found under the heading CONF-770521 in the report number index. Author (ERA)

N78-14821# Technische Hochschule, Darmstadt (West Germany). Fachgebiet Uebertragungstechnik.
A METHOD FOR SENSITIVITY ANALYSIS OF TIME-DISCRETE NETWORKS [EIN VERFAHREN ZUR EMPFINDLICHKEITSANALYSE ZEITDISKRETER NETZWERKE]
Raimund Luecker Apr. 1977 27 p refs In GERMAN
(IND-FB-97) Avail: NTIS HC A03/MF A01

A method was derived which allows the determination of the sensitivities of time-discrete networks without formal differentiations and is suitable for numerical sensitivity analysis of arbitrarily structured circuits. ESA

63 CYBERNETICS

Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

N78-14822 Vanderbilt Univ., Nashville, Tenn.
NUMERICAL SOLUTIONS TO OPTICAL CONTROL PROBLEMS GOVERNED BY FUNCTIONAL DIFFERENTIAL EQUATIONS Ph.D. Thesis
Frank Howard Mathis 1977 81 p
Avail: Univ. Microfilms Order No. 77-19386

Three numerical procedures for minimizing the cost function in optimal control problems are described. A finite difference approximation in which both the cost function and state equation are replaced by discretizations based on the midpoint difference rule was analyzed, and by careful selection of mesh spacing, a second order convergence was achieved. The centered difference method applied to boundary value problems which arise as necessary conditions for optimal control is analyzed. Convergence and convergence rates for both linear and nonlinear equations are established. A Ritz-Galerkin procedure for approximating control problems in which the cost is quadratic and the state x solves a linear delay-differential equation is considered. Error bounds for both the control and cost function convergence for arbitrary approximating subspaces are derived. Dissert. Abstr.

N78-14823 Michigan Univ., Ann Arbor.
CONVERGENCE OF QUASI-NEWTON ALGORITHMS WITH APPLICATIONS IN SINGULAR OPTIMAL CONTROL Ph.D. Thesis
Bang-Dar Cheng 1977 139 p
Avail: Univ. Microfilms Order No. 77-17966

Since optimal control problems can be transformed into function space minimization problems, an effort is made to study the convergence and rate of convergence of quasi-Newton algorithms applied to both finite-dimensional and function space minimization problems, especially singular problems. It is concluded that computational difficulties attributed to singular optimal control problems are as much a function of defects in the classical gradient and Newton methods and/or the multi-subarc character of typical singular problems as the singular problem itself. Dissert. Abstr.

N78-14824 Pennsylvania Univ., Philadelphia.
PROGRAMMABLE PERIPHERAL CONTROLLERS FOR CONTROL PROCESSING SYSTEMS Ph.D. Thesis
Phillip John Moylan 1977 313 p
Avail: Univ. Microfilms Order No. 77-19897

A Control Processing System (CPS) is defined to be that class of control systems that contain a Central Control (CC) and several Peripheral Controllers (PCs) which are directly connected to the controlled equipment. A programmable Peripheral Controller (PPC) is defined to be a universal modular control circuit that is adapted to a particular application by its control program and its interface circuitry. The PPC consists of a Minimal Processing Unit (MPU), control memory, and other support and auxiliary circuits. The MPU is defined to be a general purpose programmable parallel data processor that has a small physical size and a low cost. The system design methodology of PPCs for large complex CPS is discussed. The problems addressed are design goals, evaluation of PPCs, and PPC design procedures. Dissert. Abstr.

N78-14825 Carnegie-Mellon Univ., Pittsburgh, Pa.
NEW EXTENSIONS IN PATTERN RECOGNITION Ph.D. Thesis
Mark Allen Vogel 1976 114 p
Avail: Univ. Microfilms Order No. 77-19196

Information theory and statistical measures are utilized to provide improved algorithms. The algorithms are extensively explored through simulated data and finally their usefulness in real problems in the biomedical field is demonstrated. The general framework of application of feature processing, cluster analysis and classification is explored. A pseudo F-statistic (PFS) cluster analysis method is presented. The PFS criterion function permits the subdivision of an ensemble into an optimal set of groups, where the number of groups is not specified and no ad hoc parameters are employed. The application of this technique to medical prognosis and evaluation is then demonstrated. Development of a classification technique using trees with links based on maximization of information for discrimination is then covered. This discriminant tree classification technique is created to provide a more effective technique for classification involving discrete multistate data. Its success in applications to diagnosis of genetic disorders via dermatoglyphic (handprint) data is shown.
Dissert. Abstr.

N78-14826# Threshold Technology, Inc., Delran, N. J.
AUTOMATIC DATA ENTRY ANALYSIS Final Technical Report, 29 Mar. 1976 - 22 Aug. 1977
John R. Welch Sep. 1977 132 p refs
(Contract F30602-76-C-0178)
(AD-A045939; RADC-TR-77-306) Avail: NTIS HC A07/MF A01 CSCL 17/2

Speed and accuracy have been compared for isolated-word voice recognition, keyboard, and graphical menu data entry systems. One entry task involved simple copying of numeric and alphanumeric data strings. A second was a simulation of complex flight data entry scenario. The factors evaluated included voice response feedback and prompting, hand occupation during data entry, and subject experience. Keyboard provided the fastest and most accurate entry of numeric data strings and the fastest entry of alphanumeric strings by subjects with keyboard experience in the simple scenario, but was slow relative to voice and graphical menu for entry of words by inexperienced subjects in the complex scenario. Voice entry provided the lowest error rate for entry of alphanumeric data strings in the simple scenario primarily because of its greater immunity to reading errors. In the complex scenario, voice was faster than keyboard for inexperienced subjects, and had a similar operational error rate, but had a substantially higher error rate before correction. Graphical menu ranked between keyboard and voice in most of the simple scenario measures, except that it was least accurate with alphanumeric data, and had the lowest entry speed for long strings. GRA

N78-14827# Rice Univ., Houston, Tex. Dept. of Electrical Engineering.
AN INTERACTIVE CLUSTER DISPLAY SYSTEM
Charles Pau May 1977 18 p
(Grant AF AFOSR 2777-75, AF Proj 2304)
(AD-A045937; EE-TR-7709; AFOSR-77-1246TR) Avail: NTIS HC A02/MF A01 CSCL 09/5

A set of FORTRAN subroutines has been implemented at Rice University for the display of clusters on a Tektronix 4013 graphics terminal. The subroutines display each point as a character on a portion of the screen determined by the user. Once the main subroutine has been called, the user can interactively select one or more of the following functions: (1) Displays a sample of the points; (2) Selectively displays one or more clusters; (3) Zooms into a small section of the display area; (4) Displays only a small section of the display area; (5) Displays all but a small section of the display area; (6) Constructs decision boundaries according to criteria set up by the user; (7) Allows the user to identify points in the display area and returns the coordinates in an array upon exit from subroutine; (8) Produces a hardcopy of the display on a line printer; (9) Produces a hardcopy of the display on CalComp plotter. Author (GRA)

N78-14828# Ohio State Univ., Columbus.
A SYNTAX-DIRECTED METHOD OF EXTRACTING TOPOLOGICAL REGIONS FROM A SILHOUETTE
John O. Amoss Jul. 1977 42 p refs
(Grant AF-AFOSR-2351-72)
(AD-A045944; AFOSR-77-1227TR; OSU-CISRC-TR-77-10)
Avail: NTIS HC A03/MF A01 CSCL 06/4

The objective of this research is to develop a preprocessing technique for decomposing pictorial data into its topological units and subunits so as to enhance any subsequent feature/primitive extraction. To enhance the later stages of perception implies that each topological unit and its subunits must be labeled in such a way as to reveal their relationship to the other topological units of the pattern. If the labeling can be standardized then the feature/primitive analysis, which is very application-oriented, can process the results of the preprocessor decomposition as desired. While the proposal for such a decomposition (called segmentation or region analysis) is not new, the concept of decomposition to reveal a pattern's intrinsic structure prior to and independent of feature/primitive analysis is new.
Author (GRA)

N78-14829# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SYSTEMS WHICH RECOGNIZE ALPHANUMERIC SYMBOLS RECORDED ON A PAPER OR FILM BEARER
Z. Kedzior 4 Mar. 1977 24 p refs Transl. into ENGLISH from Nowosci Elektroniczna Tech. Obliczeniowa Inst. Maszyn Mat. (Poland), v. 13, no. 4, 1974 p 95-109
(AD-A045907; FTD-ID(RS)I-1756-76) Avail: NTIS HC A02/MF A01 CSCL 05/2

Partial contents: Optical and Magnetic Symbol Readers and Readers of Symbols Recorded on a Film Bearer; Reasons for Little Spread of Readers; Document and Page Readers and Readers of Recording Tape; Potential Buyers in Poland; Principles of Construction of OCR Systems -- Electronic subsystems, Readoff subsystems, Recognizing subsystems, and An example of design (the Hitachi H8959 reader), and Mechanisms of moving documents; Operations Carried on in Poland; and trends in Building OCR systems. GRA

N78-14830# Colorado Univ., Boulder. Systems Engineering Lab.
SYNTHESIS OF OSCILLATING ADAPTIVE SYSTEMS Interim Report

Aharon Shapiro and Isaac Horowitz 25 Jul. 1977 300 p refs
(Grant AF-AFOSR-2946-76)
(AD-A046011; AFOSR-77-1223TR) Avail: NTIS HC A13/MF A01 CSCL 09/4

Oscillating adaptive systems are non-linear feedback systems in which there circulates in the feedback loop (or loops), a signal whose frequency components are large relative to the bandwidths of the control (command and disturbance) signal components. Under certain conditions the system response to these control components is quasi-linear, permitting linear analysis accurate within stringent engineering tolerances. The system response to these control inputs can also then have zero sensitivity to the (linear time-invariant) plant high-frequency gain factor. If a linear time-invariant feedback system is designed to cope with such plants, the uncertainty in this gain factor, if very large, can lead to enormous, possibly impractical, loop bandwidths. Hence, the zero sensitivity property of the oscillating system makes them very attractive as adaptive systems. The quasi-linearity conditions permit the development of quantitative frequency-response synthesis techniques, whereby one may proceed from a statement of quantitative performance specifications and plant uncertainty bounds, step by step towards an optimum design. One significant result is that the gain factor uncertainty, inherently banished as a direct adaptive problem by the oscillating condition, reappears in different forms as a significant design constraint.
Author (GRA)

N78-14831# Colorado Univ., Boulder. Systems Engineering Lab.
REDUCTION OF THE COST OF FEEDBACK IN SYSTEMS WITH LARGE PARAMETER UNCERTAINTIES Interim Report
Patrick Rosenbaum and Isaac Horowitz 1 Aug. 1977 206 p refs
(Grant AF-AFOSR-2946-76)
(AD-A046012; AFOSR-77-1224TR) Avail: NTIS HC A10/MF A01 CSCL 12/2

This work deals with the synthesis of feedback systems to achieve specified performance tolerances, despite large uncertainty in a constrained part of the system, denoted as the plant. Part of this work deals with linear time-invariant (lti) plants where the cost of feedback, if lti compensation is used, is primarily in the bandwidth of the feedback loop being much larger than that of the system as a whole - making the system very sensitive to sensor noise. Here, the objective is to reduce the loop bandwidth by means of non-lti compensation. The result is a very significant reduction in loop bandwidth and with it, system sensitivity to sensor noise.
GRA

N78-14832# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
STABILIZING OUTPUT VECTOR FEEDBACK FOR SYSTEMS HAVING ONE INPUT PARAMETER [STABILISIERENDE AUSGANGSVEKTORRUECKFUEHRUNG FUER SYSTEME MIT EINER EINGANGSGROESSE]
R. Steinhauser May 1977 23 p refs In GERMAN
(DLR-IB-552-77/10) Avail: NTIS HC A02/MF A01

Two methods are described with which an output vector stabilization can be found, if existent, for a system with one input parameter. The first method is derived from the determination of a constant state vector feedback, the second is based on a special representation of the characteristic polynomial of the closed loop. An extension of the first method to dynamic output vector feedback is included.
ESA

N78-14833# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
DEVELOPMENT OF A CAMAC-ORIENTED CONTROL SYSTEM AND TESTING THEREOF BY MEANS OF A MEASUREMENT PROGRAM FOR ELECTRONIC EXCITATION CROSS SECTIONS M.S. Thesis [ENTWICKLUNG EINES CAMAC-ORIENTIERTEN STEUERSYSTEMS UND ERPROBUNG AM BEISPIEL EINES MESSPROGRAMMS FUER ELEKTRONISCHE ANREGUNGSQUERSCHNITTE]
Hubert Huebner Apr. 1977 96 p refs In GERMAN
(MPIS-10/1977) Avail: NTIS HC A05/MF A01; Max-Planck-Inst. fuer Stroemungsforsch., Goettingen, West Ger. DM 16,80

The development of a CAMAC program system based on DGC-NOVA and DCC D116 computers with a compatible CPU memory combination is described. Problems of the conventional programming of CRATE controllers are discussed, and a solution within the CAMAC program system is proposed. Special attention is given to interrupt processing, as well as simplification of the communication between the computer and CRATE. The measurement of an integral electronic excitation cross section by spectral analysis of the light originating from collision is described as an application.
ESA

N78-14834# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abt. Regelungstechnik.
OPTIMAL STOCHASTIC DISTURBANCE COMPENSATION BY REDUCED ORDER CONTROLLERS
Winfried Hofmann 9 May 1977 43 p refs
(DLR-FB-77-18) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 19,70

The controller design for linear dynamical systems in a Gaussian noisy environment was investigated. Using a terminal time mean-square error criterion optimal static/low-order output feedback control schemes were derived including the singular (white-noise free/colored noise measurements) control case. To circumvent the solution of a two-point boundary-value problem for the existing optimal (static) controller the assumptions of invertible (physical) control input matrix or of an instantaneous criterion have to be made. The equivalence relastionship between optimal linear filtering and output feedback with invertible control input matrix, which turns out to be important for the properties of the closed-loop system and the practical design application, is presented. A comparison of optimal, full-order, and reduced-order output feedback controllers with respect to accuracy performance and control effort was performed. The theory was applied to the design of simple but accurate feedback networks for Doppler-aided inertial navigation systems.
Author (ESA)

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N78-14835 British Library Lending Div., Boston Spa (England).
ON THE USE OF NUMERICAL METHODS FOR SOLVING THE DIFFERENTIAL EQUATIONS OF COMMUTATION
V. P. Dlugash May 1977 10 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Elektromekh. (USSR), v. 4, 1976 p 420-425
(BLL-RTS-10607) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

The aim of the investigation is: (1) to make recommendations as to the magnitude of the integration step with a view to the accuracy of the computation, and as to the regularity (stability) and convergence of the computing process, (2) to analyze the Euler and Runge-Kutta computational methods in terms of their computer running time and (3) to write an algorithm for computer use, taking into account the specific features of the differential equation systems pertaining to commutation. It was found that: (1) for a computer calculation of the commutation of a high output machine the Euler method is recommended using a variable step so as to cut down on machine running time as compared with other methods examined, (2) the Euler-Cauchy method is recommended for computing the commutation of medium output machines, and (3) in order to improve the regularity of the computing process it is recommended that the commutation equation be written in a specified form.
Author

N78-14836 State Univ. of New York, Binghamton.
A NUMERICAL METHOD FOR SYSTEMS OF ORDINARY DIFFERENTIAL EQUATIONS Ph.D. Thesis
Arthur Raefsky 1977 241 p
Avail: Univ. Microfilms Order No. 77-20130

The central idea of this method revolves around the ability to generate a numerical approximation of the general solution

of systems of linear differential equations. The idea of obtaining a numerical approximation to the general solution leads to changes in the traditional approaches for solving boundary value problems. The method is extended to solve nonlinear initial and boundary value problems by using it in conjunction with quasilinearization. The proposed method is applied to the estimation of unknown parameters in a dynamical system. The question of solving singular perturbation problems for ordinary differential equations, and problems characterized by large positive eigenvalues are also treated. Towards this end the method developed is used in conjunction with the modified quasilinearization algorithm, with a grid refinement algorithm introduced into the solution procedure. The ability to find a general solution to systems of ordinary differential equations also puts in a new light the question of solving partial differential equations via the method of lines.
Dissert. Abstr.

N78-14837 Cornell Univ., Ithaca, N. Y.
REDUCTION STRATEGIES IN SUBTREE REPLACEMENT SYSTEMS Ph.D. Thesis
Michael James ODonnell 1976 155 p
Avail: Univ. Microfilms Order No. 77-18188

Sufficient conditions are placed on Subtree Replacement Systems under which (1) normal forms are unique, (2) normal forms are found whenever they exist, (3) normal forms are found in an optimal fashion according to a reasonable cost measure. The results in (1) generalize work by Rosen, and the results in (2) and (3) are strictly new for Subtree Replacement Systems. These results are intended primarily as tools for the designer of interpreters for programming languages. Applications to LISP and Lucid are described which yield simple, efficient interpreters, and, in the case of LISP, produce a strict improvement in efficiency over the standard approach. Applications to the lambda calculus, combinator calculus and recursive equations are also described. The applications above extend the work of Henderson and Morris, Friedman and Wise on outermost LISP evaluation and the work of Cadiou, Vuillemin, Downey and Sethi on computations of recursively defined equations. Dissert. Abstr.

N78-14838 Stanford Univ., Calif.
ALGORITHMS FOR SPARSE MATRIX EIGENVALUE PROBLEMS Ph.D. Thesis
John Gregg Lewis 1977 213 p
Avail: Univ. Microfilms Order No. 77-18224

Eigenvalue problems are considered for an n by n matrix A where n is large and A is sparse. It is assumed that A is unstructured: it cannot be reordered to have narrow bandwidth, nor can linear systems of the form Ax = b be solved by special techniques. The eigenvalue problem for such a matrix is well-solved only when A is symmetric and the eigenvalues to be computed are among the largest or smallest eigenvalues of A. The Lanczos algorithm offers a very good solution in this case. Algorithms are proposed for three difficult problems: to compute one (or a few) eigenvalue(s) of a symmetric matrix where the eigenvalue(s) are not near the end of the spectrum; to compute a number of interior eigenvalues of a symmetric matrix; to compute one (or a few) eigenvalue(s) of a non-symmetric matrix. Dissert. Abstr.

N78-14839 Washington State Univ., Pullman.
ALGEBRAIC DECOMPOSITION OF PARSERS Ph.D. Thesis
Ralph Darwin Jeffords 1977 181 p
Avail: Univ. Microfilms Order No. 77-20098

The LR(k) (left-to-right scanning, producing a right parse, and using K input lookahead symbols) parsers require infeasibly large driving tables. A theory of modularization of parsers (and their corresponding grammars) is developed by considering parallel algebraic decompositions of the alphabet of a language. This theory is applied to LR(k) parsers to develop systems of coordinated component parsers, each with a much smaller input alphabet, whose parallel connection simulates the ordinary LR(k) parser. A general model which retains determinism and immediate error detection is introduced. Two instances of this model are given: one is similar to the nondeterministic system and thus amounts to a construction of component parsers from the decomposed component grammars; and the other, which is formed by merging the ordinary LR(k) driving tables, is basically a decomposition of the LR(k) parsing machine. Special encoding techniques are developed in constructing these component parsers which result in very compact encoding of the driving tables without great loss of efficiency. Dissert. Abstr.

N78-14840 Rice Univ., Houston, Tex.
ON CERTAIN FINITE SUBGROUPS OF THE NORMALIZERS OF MAXIMAL TORI Ph.D. Thesis
Alan Dean Wiederhold 1977 51 p
Avail. Univ. Microfilms Order No. 77-19302

Let G be a compact, simply-connected Lie group. In his thesis, A. Sheffer defined an extension of a certain group J (= JG), J is a finite subgroup of the normalizer of a maximal torus of G, of order 2 superscript t .0 (W), where W is the Weyl group of G and r is the rank of G. The factor 2 superscript r represents the square roots of unity in the torus. Sheffer's group J is the group generated by J together with the fourth roots of unity in the torus. J has order 4 superscript r .o(W). Sheffer proves that if G has no S cubed factor, then the isomorphism type of G is determined by that of J. It is shown that the original groups J do not suffice to determine the type of G, and in particular for distinct nonnegative integers j and k, the groups JG and JG superscript 1 for G = Spin(8j+7) x Spin(8k+6) and G superscript 1 = Spin(8j+6) x Spin(8k+7) are isomorphic. Dissert. Abstr.

N78-14841# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
THE STANDARD ELLIPSE AND ITS RELATIONSHIP TO THE RIGIDITY COEFFICIENT [A ELIPSE PADRAO E SUA RELACAO COM O COEFICIENTE DE RIGIDEZ]
Hans-Ulrich Pilchowski Jul. 1977 36 p refs In PORTUGUESE
(INPE-1052-PE/060) Avail: NTIS HC A03/MF A01

Methods of geodedic triangulation permit the use of various techniques to minimize errors of all types. The existing connection between two instruments using these techniques was presented as well as their relationship to a relative standard ellipse with inflexible coefficients. Transl. by B.B.

N78-14842# North Carolina Univ., Chapel Hill. Dept. of Statistics.
EFFECTS AND DETECTION OF SELECTIVE MODIFICATIONS IN SAMPLES: MULTIVARIATE MODELS AND TECHNIQUES Final Report, 1 Jul. 1974 - 30 Jun. 1977
N. L. Johnson 3 Oct. 1977 6 p refs
(Contract DAAG29-74-C-0030)
(AD-A045901; ARO-11959.17-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

The study of tests of censoring of extreme sample values has been the major research topic. In contrast to earlier work, aimed at evaluating the effect of using specific inaccurate estimates of population distributions, attention has been concentrated on finding how little information suffices to make tests feasible. In particular, it has been found that one complete sample, of size comparable to that of a suspected incomplete sample, and known to be from the same population, makes possible a fairly powerful test. Even when it is only known that some samples, out of two or more, are complete, it is possible to construct useful tests. The work was also concerned with extreme values, and the use of order statistics in estimating ratios - a technique which can also be applied to censored samples. Author (GRA)

N78-14843# North Carolina Univ., Chapel Hill.
EMPIRICAL TESTING OF MULTIPLICATIVE CONGRUENTIAL GENERATORS WITH MODULAS 2 TO THE 31ST POWER -1
George S. Fishman and Louis R. Moore Oct. 1977 20 p refs
(Contract N00014-76-C-0302)
(AD-A046149; TR-77-12) Avail: NTIS HC A02/MF A01 CSCL 09/2

This paper presents the results of empirically testing 8 alternative multipliers for a multiplicative congruential generator with modulus 2 to the 31st power -1. The LLRANDOM random number package uses one of the multipliers, the simulation programming language SIMSCRIPT 2 uses a second and the remaining six are the best of 50 candidate multipliers studied by Hoaglin (1976) using the theoretical spectral and lattice tests.

The battery of tests fail to detect any departures from randomness for 3 of the multipliers, even at a 0.20 significance level. This group includes the multiplier that SIMSCRIPT 2 employs. However, another of the 3 superior performers, 397204094, requires only 78 percent of the computing time that the SIMSCRIPT 2 multiplier does and is the second most efficient computationally of all 8 multipliers. Author (GRA)

N78-14844# Stanford Univ., Calif. Computer Science Dept.
ALGORITHMS FOR SPARSE MATRIX EIGENVALUE PROBLEMS M.S. Thesis
John Gregg Lewis Mar. 1977 212 p refs
(Contract EY-76-S-03-0326-030)
(SU-326P30-52; STAN-CS-77-595) Avail: NTIS HC A10/MF A01

For abstract, see N78-14838.

N78-14845# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
THE ROBERSON AND WITTENBURG ALGORITHM FOR MULTIBODY SYSTEMS WITH TREE STRUCTURE
R. Schwertassek 29 Apr. 1977 141 p refs In GERMAN; ENGLISH summary
(DLR-IB-552-77/03) Avail: NTIS HC A07/MF A01

The kinematical and dynamical equations of motion were derived, as proposed by R.E. Roberson and J. Wittenburg, using the Newton-Euler equations. The result is a set of differential equations which may be used as the basis for establishing a general purpose computer program for the simulation of the dynamics of multibody systems. The general structure of such a simulation program was derived from the equations of motion. Author (ESA)

N78-14846# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.
ZEROS OF ANALYTIC FUNCTIONS OF SEVERAL VARIABLES
Bo Berndtsson 1977 40 p refs
(CTH-Math-1977-7) Avail: NTIS HC A03/MF A01

Some questions concerning estimation of the zero sets of analytic functions in several complex variables were studied. The set of zeros of such a function is an analytic variety of pure codimension. Estimates are given from below the area of varieties defined in different kinds of domain. Some of these estimates were used to derive estimates from above the area of varieties defined by functions in various classes. The zero sets of bounded functions in tube domains and of entire functions of exponential type were studied. Results were used to prove some theorems concerning discrete sets of uniqueness for functions in several variables. These results are also interpreted as theorems on approximation in several variables. ESA

N78-14847# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.
ON THE POISSON INTEGRAL FOR LIPSCHITZ AND C1-DOMAINS
Bjoern E. J. Dahlberg 1977 22 p refs
(CTH-Math-1977-8) Avail: NTIS HC A02/MF A01

The Poisson integral was studied for Lipschitz and C1 domains. Let D be a Lipschitz domain and let Hf denote the solution of the Dirichlet problem with boundary values f. It is proved that if f is an element of L sup p(sigma), where sigma is the surface measure of delta D and p between 2 and infinity then the nontangential maximal function associated to Hf is also in L sup p. Here the exponent 2 is sharp. However, if D is assumed to be a C1-domain then the results hold for p between 1 and infinity. The method used is to characterize the corresponding Carleson measures. Author (ESA)

N78-14848# Analytical and Computational Mathematics, Zurich (Switzerland).
A SURVEY OF ROUNDING EFFECTS IN FLOATING-POINT ARITHMETIC
W. Maag and R. Wehrli Paris ESA May 1977 73 p refs
(Contract ESOC-765/75-AR)
(ESA-CR(P)-1005) Avail: NTIS HC A04/MF A01

A self contained survey on the current state of the art on the generation and propagation of rounding errors which starts from the arithmetic properties as they are currently implemented on computing machines is given. Following an overview and a general discussion of the problems, details of the arithmetics as implemented on various computers, including the representations of numbers, are discussed. The probabilistic behavior of the rounding error effects of the basic arithmetic operations is outlined. Author (ESA)

N78-14984# European Space Agency, Paris (France).
ALGORITHM FOR PARAMETER ESTIMATION FROM LINEAR OBSERVATIONS IN THE CASE OF INCOMPLETE INITIAL ESTIMATES
Claude Aumasson *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1976-5 (ESA-TT-405) Oct. 1977 p 1-15 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-5, Sep.-Oct. 1976 p 251-257 Original report in FRENCH previously announced as A77-16145 (For availability see N78-14983 05-99)
Avail: NTIS HC A05/MF A01

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N78-14849 Michigan Univ., Ann Arbor.
CROSS-VALIDATORY PREDICTIVE INTERVALS, THE BAYES CHARACTER OF SUBSET SELECTION TECHNIQUES, AND ROBUST ADAPTIVE PREDICTION Ph.D. Thesis
Ronald Warren Butler 1977 137 p
Avail: Univ. Microfilms Order No. 77-17961

A cross-validatory criterion is proposed that may be used to select a predictive interval from a prescriptive class of possible intervals. This methodology is used to predict a future observation from a location model and a general linear model. Under various weak assumptions, certain intervals are shown to have consistent coverage probabilities for a future observation. The properties of a few intervals are considered in Monte Carlo studies that use independent, identically distributed data with normal, Cauchy, and uniform errors. The admissibility of two residual error criteria for subset selection of independent variables in normal multivariate multiple regression is demonstrated. Dissert. Abstr.

N78-14850 Michigan State Univ., East Lansing.
ASYMPTOTIC NORMALITY OF SIMPLE LINEAR RANDOM RANK STATISTICS UNDER THE ALTERNATIVES Ph.D. Thesis
Janet Tolson Eyster 1977 64 p
Avail: Univ. Microfilms Order No. 77-18477

The problem of asymptotic normality of random signed rank statistics under the alternatives when the score functions, psi, are bounded. When the random variables are independent and identically distributed, psi is assumed to be square integrable. To relax the assumptions of differentiability on psi, restrictions are placed on the distribution functions of the random variables. This work is useful in generating bounded length confidence intervals for the regression problems. Dissert. Abstr.

N78-14851 Michigan State Univ., East Lansing.
OPERATIONALLY DEFINING THE ASSUMPTION OF INDEPENDENCE AND CHOOSING THE APPROPRIATE UNIT OF ANALYSIS Ph.D. Thesis

Linda Kay Glendening 1977 191 p
Avail: Univ. Microfilms Order No. 77-18482

The assumption of independence was operationally defined as: Individual units (such as students) can be considered independent on some dimension whenever the variance of the grouped units (such as classrooms) can be predicted from the grouping size and the variance of the individual units. When this definition of independence is satisfied, the expected mean squares between and within groups are equal. Given this operational definition, two types of dependence are possible, positive and negative. Positive dependence was defined by the expected mean square between groups being larger than the expected mean square within groups. Negative dependence was defined by the expected mean square within groups being larger than the expected mean square between groups. Dissert. Abstr.

N78-14852 George Washington Univ., Washington, D. C.
A STATISTICAL ANALYSIS OF SOME MODELS USED IN ACCELERATED LIFE TESTS Ph.D. Thesis
Henry David Kahn 1977 69 p
Avail: Univ. Microfilms Order No. 77-19817

The problem of inference for the parameters of three models used in accelerated life tests was considered. The first part obtained orthogonal least squares estimators for the parameters of the models. The second part considered a Bayesian analysis of the two parameters of the power rule model. The absolutely continuous bivariate exponential (ACBVE) distribution was assigned as a joint prior on the power rule parameters. The analysis proceeded along the lines dictated by Box and Tiao. Thus, location parameters were introduced in the ACBVE so that the prior was shifted to a position where the likelihood is appreciable. For computational convenience, the joint prior was discretized over regions of the parameter space where the likelihood was appreciable. This approach allowed some generality in the choice of joint priors. Using this approach, conclusions were reached pertaining to the robustness of the inferences with respect to assumptions about the Weibull shape parameter. Dissert. Abstr.

N78-14853 Johns Hopkins Univ., Baltimore, Md.
ROBUST ESTIMATION BY STOCHASTIC APPROXIMATION AND ERROR MODELS FOR ROBUST PROCEDURES Ph.D. Thesis
Edward LeBaron Price 1977 105 p
Avail: Univ. Microfilms Order No. 77-19602

It is shown that Huber's robust estimation of location problem has a solution which is a form of the Robbins-Monro stochastic approximation algorithm. This is in addition to the M-estimate solution already established by Huber. As with the M-estimate solutions, the stochastic approximation solutions are completely determined by the probability distribution of least Fisher information in the distribution set used to model the uncertainty in the problem. It is observed that in certain procedures for robust detection of known signals in noise, the minimum information distribution also defines the most robust procedure. The problem of computing the distribution of minimum Fisher information in a given set from one of several general classes is considered. Dissert. Abstr.

N78-14854# Center for Naval Analyses, Arlington, Va. Operations Evaluation Group.
SEMI-MARKOV PROCESSES: AN INTRODUCTION
Walter R. Nunn and Anthony M. Desiderio Jul. 1977 30 p refs
(Contract N00014-76-C-001)
(AD-A046158; CRC-335) Avail: NTIS HC A03/MF A01 CSCL 12/1

This research contribution describes the basic methodology for analyzing semi-Markov processes and demonstrates how to solve the necessary equation numerically. Two mechanisms for producing semi-Markov processes are described and examples presented. Algorithms needed to analyze semi-Markov (continuous- and discrete-time) processes are derived. Author (GRA)

N78-14855# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.
A COUNTEREXAMPLE TO R. DAVIDSON'S CONJECTURE ON LINE PROCESSES
Olav Kallenberg 1977 11 p refs
(CTH-Math-1977-1) Avail: NTIS HC A02/MF A01

In 1968 Rollo Davidson conjectured that every stationary second order line process in the plane which has as such no parallel lines is necessarily a Cox (or doubly stochastic Poisson) process. This conjecture is disproved. An affirmative answer is also given to the question whether there exists a lattice type point process in the plane which is stationary under an arbitrary area preserving affine transformations. Author (ESA)

N78-14856# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.
INVARIANCE IN THE LINEAR MODEL: AN ARGUMENT FOR CHI SQUARE AND F IN NON-NORMAL SITUATIONS
Peter Jagers 1977 17 p refs
(CTH-Math-1977-4) Avail: NTIS HC A02/MF A01

It is claimed that, for a suitable norm, conservation of the distance between the expectation and the hypothesis furnishes a basis for data reduction by invariance in the linear, not necessarily normal, model. If the norm is Euclidean (i.e. based on some inner product), the maximal invariant is a pair of sums of squares. This provides support for traditional chi square (or F) methods also in non-normal cases. If the norm is l to power p, with p not equal 2, or the subnorm, the maximum invariant is, at best, a pair of order statistics. Author (ESA)

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N78-14857 State Univ. of New York, Stony Brook.
FAILURE DETECTION IN LINEAR SYSTEMS USING FUNCTION OBSERVERS Ph.D. Thesis
Saul Lester Keslowitz 1977 156 p
Avail: Univ. Microfilms Order No. 77-20033

The function observer has appealing aspects such as reduced computer computation and storage. Two types of failure models are discussed. A type I failure involves modelling each system failure mode as a matrix triplet (A, B, H), denoting the identity of the failed system, and a type II failure involves an unknown time sequence being added to one input component or one output component. Failure information is obtained from scalar residuals, which are formed by comparing a linear function of system state to an estimated function of system state. The effects of noise on the failure indicators are discussed and statistical approaches that may be taken when attempting to detect these failures are suggested. The point is emphasized that while the minimum order observer that directly observes the state of a linear system is typically n-m, by using function-of-state observers, the dimension may be considerably less than this. Dissert. Abstr.

N78-14858 California Univ., Los Angeles.
ADAPTIVE CONTROL FOR A CLASS OF STOCHASTIC LINEAR DIFFERENTIAL GAME Ph.D. Thesis
John Yem-Pui Lai 1977 161 p
Avail: Univ. Microfilms Order No. 77-19636

The analytical solutions obtained for the optimal control require the solving of a two point boundary value problem which often requires numerical iterations. However, the assumption of known system dynamics may not be applicable to real-life situations, and an adaptive controller is necessary to generate an asymptotically optimal control. The problem is posed such that the evader has noisy state measurements with parameter uncertainties while the pursuer has perfect knowledge of both the state and system parameters. The controller scheme for the evader consists of three functional blocks, an identifier which gives a better system parameter estimates for each noisy measurement, a Kalman type filter for state estimation and a controller for control generation. An interception example is worked out analytically and a numerical simulation is also carried out with the input gain matrices being unknown to the evader. Convergence of the identifier and estimator is shown to be good. Finally, a conclusion with suggestions for future research is presented. Dissert. Abstr.

N78-14859 Pennsylvania Univ., Philadelphia.
OPTIMAL CONTROL OF BULK QUEUES Ph.D. Thesis
Yasar Mehmet Atacik 1977 107 p
Avail: Univ. Microfilms Order No. 77-19822

A queueing system is considered where service is provided by a single server which serves the customers in batches. Initially it is assumed that the service capacity is infinite-later, this assumption is relaxed. The arrival process is a general nondecreasing jump process; Poisson and compound Poisson arrival processes are special cases of it. Costs are incurred for service and for keeping items (people) waiting. Waiting costs can be thought of as inventory holding costs when material goods are the object of study. The objective is to determine operating policies that minimize the total discounted cost. Optimal operating policies are obtained when the waiting cost is linear or convex and when the service cost is linear or concave. Dissert. Abstr.

N78-14860 Kansas State Univ., Manhattan.
SYSTEM EFFECTIVENESS MODELS FOR MAINTAINED SYSTEMS: ANALYTIC AND SIMULATION APPROACH Ph.D. Thesis
Chang Hoon Lie 1977 430 p
Avail: Univ. Microfilms Order No. 77-18612

Mission effectiveness, which is the probability of successfully completing the assigned mission, is introduced as a practical measure of system effectiveness. Mission effectiveness models are developed for several illustrative systems. The models combine the effects of various factors. An appropriate combination of these factors is determined based on the operational or mission requirements of the system under consideration. Both analytical and simulation approaches are employed in developing the models. Simulation approach is proved to be more practical than the analytical approach because simulation approach can handle any probability distributions, can include the transient effects into the model, and is easy to implement in practice. The models are illustrated by applying them to the military systems. The models were used in an analysis of the data taken from the test report of a military system. Sensitivity of some data elements to be mission effectiveness is observed to identify the critical data element, thereby to provide direction and thoroughness to the test planning. Dissert. Abstr.

N78-14861# Ohio State Univ., Columbus. Computer and Information Science Research Center.
CLOSENESS AND REFORMULATION: TWO COGNITIVELY-BASED IDEAS FOR PROBLEM SOLVING
Fernando Gomez and B. Chandrasekeran Jul. 1977 27 p refs
(Grant AF-AFOSR-2351-72)
(AD-A045945; OSU-CISRC-TR-77-11; AFOSR-77-1228TR) Avail: NTIS HC A03/MF A01 CSCL 12/2

The approach presented to problem-solving has two components: Closeness and reformulation. The closeness measure is a cognitively-based heuristic function, and reformulation provides the problem-solver with new ways of looking at the goal and is mediated by the closeness measure. The proposed ideas are applied to many problems that have traditionally been used to test problem-solving ideas. GRA

N78-14862# Delaware Univ., Newark. Dept. of Statistics and Computer Science.
THE M/M/1 QUEUE WITH RANDOMLY VARYING ARRIVAL AND SERVICE RATES
Marcel F. Neuts Jul. 1977 26 p refs
(Grant AF-AFOSR-3236-77)
(AD-A045943; TR-77/11; AFOSR-77-1233TR) Avail: NTIS HC A03/MF A01 CSCL 12/2

Computationally feasible solutions are studied for a number of problems related to a M/M/1 queue in which the arrival and service rates vary according to the state of an underlying Markov chain. Our results may be used to mode the effects of rush-hour phenomena or other extraneous fluctuations on the characteristics of an M/M/1 queue. GRA

N78-14863# Delaware Univ., Newark. Dept. of Statistics and Computer Science.
THE SECOND MOMENTS OF THE ABSORPTION TIMES IN THE MARKOV RENEWAL BRANCHING PROCESS
Marcel F. Neuts Jul. 1977 14 p refs
(Grant AF-AFOSR-3236-77)
(AD-A045942; TR-77/12; AFOSR-77-1232TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Explicit formulas are derived for the second moments of the absorption time matrices in the Markov Renewal Branching process. These formulas may easily be computationally implemented and are useful in the iterative computation of the semi-Markov matrices, which gives the distributions of the duration and of the number of customers served in a busy period of a great variety of complex queueing models. GRA

N78-14864# Brookhaven National Lab., Upton, N. Y.
ANALYSIS OF DISCRETE-TIME QUEUES FOR RANDOM OUTPUT PROCESSES AND NETWORK SOLUTIONS
Andrew S. Noetzel 1977 7 p refs Presented at 11th Ann. Conf. on Inform. Sci. and Systems, Baltimore, Md., 30 Mar. 1977
(Contract EY-76-C-02-0016)
(BNL-22580; Conf-770349-2) Avail: NTIS HC A02/MF A01

The relationships between the local balance and random output properties of queues, and the product from solution for networks of queues, are established by analyzing finite discrete-time queues, with Bernoulli processes for random output condition. The results can be extended to continuous-time queues with Poisson output processes. It is shown that the random output condition is necessary but not sufficient for the network product from solution. Although not all the necessary steps are proven, intuitive arguments and sample cases are shown to indicate an equivalence between a generalized form of local balance and the network product form solution. ERA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N78-14865 Stanford Univ., Calif.
EXISTENCE AND REGULARITY THEOREMS FOR SOME GEOMETRIC VARIATIONAL PROBLEMS Ph.D. Thesis
Richard Melvin Schoen 1977 126 p
Avail: Univ. Microfilms Order No. 77-18247

The regularity problem for solutions of the codimension one Plateau problem for general elliptic parametric functionals is discussed. A complete new proof of interior regularity almost everywhere is given for rectifiable currents which provide absolute minima of elliptic parametric functionals. The proof is based on a nonparametric approximation and standard PDE estimates. The argument is completely direct. New regularity estimates are also given for hypersurfaces which are stable with respect to functionals whose coefficients are sufficiently close to those of the area functional. These estimates are direct intrinsic estimates, and they yield complete regularity in dimension two. An existence and uniqueness theorem is also given for the Dirichlet boundary value problem for harmonic mappings with prescribed homotopy class into complete Riemannian manifolds of nonpositive sectional curvature. The method used is the heat equation method, and the result follows from the work of Hamilton and a parabolic estimate which implies that the image remains inside a compact set. Dissert. Abstr

N78-14866 This accession not used

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

No abstracts in this category.

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N78-14867* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DIFFERENTIAL SOUND LEVEL METER Patent
Allan J. Zuckerwar, inventor (to NASA) (Old Dominion Univ., Norfolk, Va.) Issued 6 Dec. 1977 13 p Filed 8 Nov. 1976 Supersedes N77-23441 (15 - 14, p 1854) Sponsored by NASA
(NASA-Case-LAR-12106-1; US-Patent-4,061,041; US-Patent-Appl-SN-740156; US-Patent-Class-73-646; US-Patent-Class-330-52) Avail: US Patent Office CSCL 20A

Small differences between relatively high sound pressure levels at two different microphone sites are measured by a device which provides electrical insertion voltages (pilot voltages) as a a means for continuously monitoring the gains of two acoustical channels. The difference between two pilot voltages is utilized to force the gain of one channel to track the other channel.
Official Gazette of the U.S. Patent Office

N78-14868 Johns Hopkins Univ., Baltimore, Md.
THE OPTICAL MEASUREMENT OF ULTRASONIC STONELEY WAVES Ph.D. Thesis
Richard Otto Claus 1977 171 p
Avail: Univ. Microfilms Order No. 77-19582

A numerical solution of the determinantal Stoneley wave velocity equation indicates the theoretical existence of Stoneley waves on the boundaries between transparent and opaque materials. Using differential interferometry and calibrated synchronous detection, Stoneley waves which induced 0.11 A particle motions near the boundary between isotropic nickel and borosilicate glass samples were detected. The waves were generated by surface wave conversion at the corners of obstacles and by internal longitudinal wave phase matching. Modifications of this technique were used to measure the attenuation of Rayleigh waves on fused quartz as a function of depth below the surface. Schoch effect measurements within the water cell utilized to generate Rayleigh waves partially confirmed the theory of leaky wave generation and allowed experimental optimization of longitudinal-to-surface wave conversion. Dissert. Abstr.

N78-14869 George Washington Univ., Washington, D. C.
ACOUSTIC PROPAGATION THROUGH A WALL-JET FLOW WITH COMPLIANT PLATES Ph.D. Thesis
Ramani Ramakrishnan 1977 156 p
Avail: Univ. Microfilms Order No. 77-20082

An analytical study of sound propagation through a wall jet flow with compliant walls was carried out. The prime objective was to evaluate the influences of flow convection and refraction of the nonuniform mean flow on sound radiation. The acoustic attenuation character of the wall admittances was calculated. The results show that the modal expansion procedure can be applied successfully to investigate the present problem. The nonuniform mean flow reduced the source power output compared to the power output of the given source in stationary medium. The flow convection and shear refraction produced a significant effect on the sound directivity which showed a steep downstream valley. The compliant wall increased the dip of the valley created by the nonuniform flow in most of the cases. The liners had a strong influence on the mode shapes, but failed to show significant acoustic attenuation properties. The small sound reduction observed in this study implies that the major effects of the liners are hydrodynamic, related to the source reduction.
Dissert. Abstr.

N78-14870 Pennsylvania Univ., Philadelphia.
ACOUSTICAL IMAGING WITH AN ELECTRONICALLY FOCUSED ARRAY Ph.D. Thesis
Constadinos Nianios 1977 174 p
Avail: Univ. Microfilms Order No. 77-1989

The effects of incoherent object insonification on images formed by an electronically focused acoustical imaging system are studied. The line spread function is derived using the Fresnel-Kirchhoff diffraction integral, and the conditions under which a transfer function can be defined and the imaging system become isoplanatic. The possible operating modes of this imaging system are studied and the parameters (lateral resolution, longitudinal resolution, minimum focusing distance, sidelobe levels, etc.) are theoretically examined and experimentally verified. The effects of incoherent insonification are theoretically analyzed and the advantages of incoherent insonification in reducing image artifacts, improving the signal-to-noise ratio and providing images of objects that normally reflect coherent waves specularly, are verified experimentally. Dissert. Abstr.

N78-14871 Central Electricity Generating Board, London (England).
MEASUREMENT OF ULTRASONIC SCATTERING COEFFICIENT WITH MULTIPLE SCATTERING
K. Goebbels 30 Jun. 1977 9 p refs Transl. into ENGLISH from Materialpruefung (West Ger.), v. 18, no. 3, Mar. 1976 p 86-88
(BLL-CE-Trans-7021-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.

Ultrasonic attenuation consists of absorption and scattering. If these effects can be separated, an assessment of the structure, (essentially a determination of the grain size of metallic materials) is possible by means of the scattering coefficient on its own. Current methods are based on the combination of two measurements of scattering and on assumptions on absorption. A derivation concerning multiple scattering is given, which allows the determination of the scattering coefficient with one measurement and without assumptions on absorption. Examples of measurements on various steels confirm the result of this theory within limits of measuring accuracy. Author

N78-14872# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
SOUND LEVEL MEASUREMENTS Final Report
3 Jun. 1977 33 p Supersedes MTP-3-2-811
(AD-A046109; TOP-1-2-608; MTP-3-2-811) Avail: NTIS HC A03/MF A01 CSCL 17/1

Provides methods of measuring noise levels of materiel as a means of evaluating personnel safety, speech intelligibility, and security from acoustic detection. Covers steady-state and impulse noise from military vehicles, weapon systems, and noise-generating machinery. Includes impulse noise tests of explosive ordnance materiel. Not applicable to explosive ordnance blast effects such as lethality. Author (GRA)

N78-14873# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
NOISE MEASUREMENTS ON CUTTING TORCHES, HEATING AND SCARFING
A. Dinkelacker, W. J. Hiller, W. Kraemer, and G. E. A. Meier Mar. 1977 238 p refs In GERMAN; ENGLISH summary Sponsored by Messer Griesheim GmbH, Frankfurt am Main
(MPIS-13/1976) Avail: NTIS HC A11/MF A01; Max Planck Inst. fuer Stroemungsforsch., Goettingen, West Ger. DM 35.20

The noise radiation of 10 cutting torches, one scarfing torch, and 11 heating torches was measured under conditions close to actual working conditions. Some measurements were also performed under special conditions aimed at gaining more detailed insight into the mechanisms of the generation and reduction of torch noise. The results are presented graphically. Measurements show that when cutting steel thicker than 100 mm, the noise levels measured at a distance of 1.5 m are usually higher than 90 db(A). Peak values up to 110 db(A) were found when cutting 300 mm steel. For the heating torches at a distance of 1.5 m, noise levels between 80 and 115 db(A) were found.

The fact that for all torches investigated the frequencies of most intense radiation are greater than 2 kHz suggests several means for possible noise reduction. Preliminary experiments show that the application of comparatively simple screening devices can lead to noise reductions of the order of 10 db. Author (ESA)

N78-14874# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
DESCRIPTION OF NOISE MEASUREMENT AND ANALYSIS PROCEDURES DEVELOPED FOR LIGHT GENERAL AVIATION AIRCRAFT
D. W. Andrews and D. W. Durenberger Apr. 1977 82 p refs (VTH-LR-246) Avail: NTIS HC A05/MF A01

The equipment, flight test procedures, and analysis methods used in the aircraft noise research program at the university are described. It is intended as a summary of techniques and a guide for establishing future programs. In this program the idea has been to make accurate, systematic sound measurements of representative general aviation aircraft during level and climbing flyovers to determine sound time histories and calculate peak noise levels and other sound related parameters. The results of these measurements are given in other Delft memorandums and may be useful in affecting design or operational changes in light aircraft. Author (ESA)

N78-14875# Cambridge Univ. (England). Dept. of Engineering.
A DIFFERENTIAL MICROPHONE FOR IN-DUCT ACOUSTIC MEASUREMENTS
C. M. E. Riley London Aeron. Res. Council 1977 17 p refs Supersedes ARC-36800 Sponsored partly by Min. of Defence, Rolls-Royce (1971) Ltd., and Sci. Res. Council
(ARC-R/M-3799; ARC-36800) Avail: NTIS HC A02/MF A01; HMSO £ 3.25; PHI $12.55

A brief description is given of a technique using a differential microphone to measure the sound field structure within the duct of a rotor. The advantages and problems of direct in-duct, as opposed to far-field, measurement are discussed, and the present approach presented. The construction and calibration of the differential microphone are briefly described, and results from some of the experiments in which it was assessed are used to demonstrate its application. Author (ESA)

N78-14986# European Space Agency, Paris (France).
CONVECTION AND REFRACTION OF ACOUSTIC WAVES IN AN OPEN WIND TUNNEL FLOW
Sebastien Candel and Alain Guedel *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1976-5 (ESA-TT-405) Oct. 1977 p 31-63 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-5, Sep.-Oct. 1976 p 269-288 Original report in FRENCH previously announced as A77-16147 (For availability see N78-14983 05-99)
Avail: NTIS HC A06/MF A01

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N78-14876 Notre Dame Univ., Ind.
SELF-ENERGY CORRECTIONS TO THE K-ELECTRON BINDING IN HEAVY AND SUPERHEAVY ATOMS Ph.D. Thesis
Kwok-tsang Cheng 1977 44 p
Avail: Univ. Microfilms Order No. 77-18291

The self-energy corrections of order alpha to the K-electron binding energy in high Z atoms are studied numerically throughout the range Z = 70-160. Nuclear finite size effects are included in the electron wave functions and in the electron propagator to avoid the Coulomb singularity at Z alpha = 1. Denoting the self-energy correction by delta E = alpha (Z alpha) to the 4th power F (Z alpha) mc squared over pi, it is found that F(Z alpha) increases smoothly from a minimum near Z=90 through f(100 alpha) = 1.46 + or - 0.01 to F(160 alpha) = 3.34 + or - 0.16. For comparison in a Coulomb field for Z between 50 and 130 are evaluated, and the values of F(Za) thus obtained are in close agreement with previously published values; the Coulomb field values of F(Za) are very close to the finite nucleus results for Z less 90. Dissert. Abstr.

N78-14877 Rice Univ., Houston, Tex.
KINETIC PROCESSES IN DENSE RARE GASES EXCITED BY AN ELECTRON BEAM Ph.D. Thesis
Robert E. Gleason, Jr. 1977 89 p
Avail: Univ. Microfilms Order No. 77-19252

A low-intensity pulsed electron beam was used to excite pure rare gases and binary mixtures of rare gases with various other species. The time dependence of emission in the ultraviolet and visible was measured using the single photon counting technique in order to determine the kinetic and radiative processes which control the behavior of excited states. The effects of collisions with ground state atoms and electrons which induce transitions between two excited molecular states were investigated in condensed phases of argon and xenon. Time resolved spectral data for solid xenon. Emission features of xenon-argon and xenon-krypton are also discussed. Dissert. Abstr.

N78-14878 Washington State Univ., Pullman.
SCATTERING OF METASTABLE MOLECULES FROM GAS COVERED Si(100) AND W(100) SURFACES Ph.D. Thesis
Donald Edward Lebsack 1977 116 p
Avail: Univ. Microfilms Order No. 77-20100

The scattering of thermal energy beams of metastable Ne, He, N2, and Ar from gas covered Si(100) and W(100) was investigated. Angular scattering distributions using the time-of-flight method of detection were obtained. Considerable differences in the scattered time-of-flight distribution as compared to the incident distribution were observed. Metastable survival is shown to be nearly inversely proportional to the normal component of velocity. The dependence of the metastable intensity as a function of crystal temperature was also measured. An approximate theoretical expression for the probability of survival which included the effect of changing velocity was derived. Dissert. Abstr.

N78-14879 Rice Univ., Houston, Tex.
THEORY OF LOW-ENERGY ELECTRON-MOLECULE COLLISION PHYSICS IN THE COUPLED-CHANNEL METHOD AND APPLICATION TO e-CO2 SCATTERING Ph.D. Thesis
Michael Alfred Morrison 1977 319 p
Avail: Univ. Microfilms Order No. 77-19277

A theory of electron-molecule scattering based on the fixed-nuclei approximation in a body-fixed reference frame was formulated. A single-center coupled-channel method which incorporates a highly accurate static interaction potential, an approximate local exchange potential, and an induced polarization potential was used. The application to e-CO2 scattering in the 0.07 to 10.0 e V energy range produced converged results in good agreement with observed cross sections. Aspects of the physics of this collision discussed include the 3.8 eV shape resonance, which is found to possess both p and f character, and the anomalously large low-energy momentum transfer cross sections, which are found to be due to sigma g symmetry. Comparisons with static and static-exchange approximations reveal that neither predicts the correct physical properties of the collision; accurate results are obtained only in the static-exchange-with-polarization approximation. Dissert. Abstr.

N78-14880# Alabama Univ., University.
THEORETICAL STUDIES ON EXCITED MOLECULAR VIBRATION STATES Final Report, 1 Nov. 1975 - 30 Jun. 1977
A. Burke Ritchie and B. R. Tambe Oct. 1977 29 p refs (Grant DAAG29-76-G-0081)
(AD-A045902; ARO-13582.1-R-C) Avail: NTIS HC A02/MF A01 CSCL 20/8

Calculations are performed for the scattering of electrons from H2(-) in the fixed-nuclei approximation. It is assumed that amplitudes for rotationally and vibrationally inelastic scattering can be constructed knowing the parameters of the elastic scattering for the fixed nuclei adiabatic nuclei theory; thus emphasis has been on the determination of accurate elastic scattering parameters in the fixed-nuclei approximation. The hydrogen molecular ion was chosen as a prototype target because

its states are known exactly (in the Born-Oppenheimer theory) or can be represented accurately using variational theory. Calculations are carried out for coupled and uncoupled single-center partial waves. Significant disagreement with earlier work is obtained based on the projection technique used to obtain the static-exchange potential. In particular the p-wave phase shifts (or eigenphases in the coupled approximation) are significantly smaller when the projection onto the space of the target electron is made with the full target ls(sigma sub g) eigenstate, rather than only its zeroth-order component.
Author (GRA)

N78-14881# Laboratoire de Physique Nucleaire des Hautes Energies, Palaiseau (France).
CORRECTION OF EFFECTS DUE TO REACTIONS ON COMPLEX NUCLEI IN A SAMPLE OF HYDROGEN-LIKE ANTIPROTON ANNIHILATIONS FROM A HEAVY LIQUID BUBBLE CHAMBER EXPERIMENT
E. Fett (Bergen Univ.), A. Haatuft (Bergen Univ.), J. M. Olsen (Bergen Univ.), W. Hart (CERN), D. Waldren (CERN), P. Alibran, B. Degrange, R. Arnold (Centre de Rech. Nucl., Strasbourg), J. P. Engel (Centre de Rech. Nucl., Strasbourg), and S. DeUnanumo (Centre de Rech. Nucl., Strasbourg) [1977] 17 p refs Submitted for publication
(LPNHE/X/77-02) Avail: NTIS HC A02/MF A01
A method is presented, which has been used to determine the pion multiplicity distributions for antiproton annihilations on free protons from a sample of events obtained in a heavy liquid bubble chamber experiment. The method uses data obtained in the experiment in question together with the usual invariance principles satisfied by strong interactions. Furthermore, no particular nuclear model is assumed. Author (ESA)

N78-14882# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
NEUTRAL CURRENT NEUTRINO PRODUCTION OF DELTA (1236)
A. LeYaouanc, L. Oliver, O. Pene, J.-C. Raynal, and C. Longuemare (Lab. de l'Accelerateur Lineaire, Orsay, France) [1976] 23 p refs
(LPTHE-76/13) Avail: NTIS HC A02/MF A01
The isovector vector and axial vector neutral current couplings were studied by analyzing the neutral neutrino and antineutrino production of the delta (1236) resonance. A quark model was used to predict the multipole structure and q square dependence of the matrix elements. This model has been developed elsewhere for the charged case. The relevant quantities: production cross sections and angular distribution of decay products are discussed. Measurable combinations of polarization density matrix elements are shown to be very sensitive to the relative magnitude and sign of the vector and axial vector couplings. One can determine up to an ambiguity the vector and the axial vector couplings by measuring the neutrino and the antineutrino cross sections. The ambiguity can be solved by studying the angular distribution of the decay products. Experiments must be performed at not too high energies, for which the vector-axial-vector interference term is sizeable. For pion neutrino production on nuclei, if the recoil proton is observed, and if the piN mass is consistent with the delta (1236) regions, the nuclear charge exchange corrections are lowered substantially with respect to the situation considered by Adler, Nussinov, and Paschos, in which only the pion is assumed to be observed. Author (ESA)

N78-14883# Laboratoire de Physique Theorique et Particules Elementaires, Orsay (France).
MONOPOLES, VORTICES AND THE GEOMETRY OF THE YANG-MILLES BUNDLES
Z. F. Ezawa and H. C. Tze (Stanford Linear Accelerator Center, Calif.) Feb. 1976 12 p refs
(LPTPE-76/3) Avail: NTIS HC A02/MF A01
A topological classification of monopoles and vortices is formulated in terms of fiber bundles. The distinction between Dirac and 't Hooft monopoles is made in the light of the confinement problem. Finite length vortices with Dirac monopoles at the endpoints are also discussed. Author (ESA)

N78-14884# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
INELASTIC SCATTERING EXPERIMENTS TO INVESTIGATE THE ROTATION AND VIBRATION EXCITATION OF H2-MOLECULES BY LOW ENERGETIC Li(+)-IONS Ph.D. Thesis - Goettingen Univ., West Ger. [INELASTISCHE STREUEXPERIMENTE ZUR UNTERSUCHUNG DER ROTATIONS- UND VIBRATIONSANRE GUNG VON H2-MOLEKUELEN DURCH NIEDERENERGETISCHE Li(+)-IONEN]
Manfred Faubel Dec. 1976 179 p refs In GERMAN
(MPIS-29/1976) Avail: NTIS HC A09/MF A01; Max-Planck-Inst. fuer Stroemungsforsch., Goettingen, West Ger. DM 28,80
The excitation of the rotation and vibration energy levels of the hydrogen molecule by low energy lithium ions was studied. The resolution of an energy loss spectrum by experiments with crossed molecular beams was formulated quantitatively and a Li-7(+)-H2 molecular scattering experiment to resolve the transition from the rotation ground state J=0 to J=2 was developed. A time-of-flight spectrum at scattering angles between 15 and 50 deg and at an energy of 0.6 eV, at which conditions both states are resolved, was obtained. In order to permit comparison with theoretical cross section calculation the data measured were transformed into relative differential inelastic effective cross sections and/or transition probabilities. Comparison with 'ab initio' calculations showed differences of less than 20 to 30%. ESA

N78-14885# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
ON ALKALI-MERCURY INTERACTION CONSIDERING ELECTRONICALLY EXCITED STATES OF THE ALKALIES [ZUR ALKALI-QUECKSILBER-WECHSELWIRKUNG UNTER BERUECKSICHTIGUNG ELEKTRONISCH ANGEREGTER ZUSTAENDE DER ALKALIEN]
Rudolf Dueren Feb. 1977 63 p refs In GERMAN
(MPIS-7/1977) Avail: NTIS HC A04/MF A01; Max-Planck-Inst. fuer Stroemungsforsch., Goettingen, West Ger. DM 12,15
A model potential calculation of the alkali-mercury interaction considering the P-level of the alkali atoms was made. The essential results for the excited states are four different intersections of which one at small distance of the nuclei is responsible for the coupling ground state-excited state. The threshold energy of this coupling is higher than the asymptotic energy of the P-state. The other three intersections combine the two P-states with the projection quantum number at small, medium, and large distances of the nuclei. The threshold for the coupling at small distance is again higher than the asymptotic energy of the P-level, the other two are lower. The cause for the intersections found are specific multipole moments of the potential development. ESA

N78-14886# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.
ON THE INDEPENDENCE OF VELOCITIES IN A SYSTEM OF NON-INTERACTING PARTICLES
Olav Kallenberg 1977 10 p refs
(CTH-Math-1977-10) Avail: NTIS HC A02/MF A01
Consider a system of non-interacting particles moving at constant speeds in a Euclidean space. It is shown that, if at two or more epochs the velocities are independent of the positions and i.i.d., then the positions must be given by a Cox process of a very special structure. Author (ESA)

N78-14887# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Angewandte Gasdynamik.
INTENSITY, ANGULAR DISTRIBUTION AND POLARIZATION OF SPONTANEOUS MOLECULAR LIGHT SCATTERING
Klaus Stursberg 26 May 1977 149 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-438)
(DLR-FB-77-20) Avail: NTIS HC A07/MF A01; DFVLR, Cologne DM 60,50
Light scattering theories are outlined for single systems such as free atoms and molecules. To a fair approximation the results apply to gases. The effect of molecular interactions within liquids and crystals on the light scattering phenomenon is shown on the basis of empirical data. The generally accepted quantum-

mechanical and classical theory of the spontaneous molecular light scattering and the special theory of Rayleigh and Raman scattering are treated. The scattering cross sections, which characterize the light scattering by single particles, the intensity of light scattered by a large number of molecules, the angular distribution, and the degree of depolarization of the scattered light are given as functions of the polarization state of incident light and direction of observation. In order to confirm the theoretical statements and to allow a numerical treatment of the given equations the experimental results of light scattering analysis are presented. Since the specific vibration and rotation constants, the degree of depolarization, and the refractive index in vibration and rotation constants, the degree of depolarization, and the refractive index are known for many gases, the frequencies, the intensity distribution, the polarization state, and the angular distribution of Rayleigh and Raman scattering can be calculated. Author (ESA)

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

No abstracts in this category.

N78-14888 This accession not used.

74 OPTICS

Includes light phenomena.

N78-14889* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.

FIBER OPTIC MULTIPLEX OPTICAL TRANSMISSION SYSTEM Patent

Charles H. Bell, inventor (to NASA) Issued 6 Dec. 1977 8 p Filed 18 Aug. 1976 Supersedes N77-15826 (15 - 06, p 0813)

(NASA-Case-KSC-11047-1; US-Patent-4,061,577; US-Patent-Appl-SN-715485; US-Patent-Class-250-199; US-Patent-Class-358-142; US-Patent-Class-179-91R) Avail: US Patent Office CSCL 20F

A multiplex optical transmission system which minimizes external interference while simultaneously receiving and transmitting video, digital data, and audio signals is described. Signals are received into subgroup mixers for blocking into respective frequency ranges. The outputs of these mixers are in turn fed to a master mixer which produces a composite electrical signal. An optical transmitter connected to the master mixer converts the composite signal into an optical signal and transmits it over a fiber optic cable to an optical receiver which receives the signal and converts it back to a composite electrical signal. A de-multiplexer is coupled to the output of the receiver for separating the composite signal back into composite video, digital data, and audio signals. A programmable optic patch board is interposed in the fiber optic cables for selectively connecting the optical signals to various receivers and transmitters.

Official Gazette of the U.S. Patent Office

N78-14890 City Univ. of New York.

THE THEORY AND EXPERIMENT OF AN OPTICAL DEVICE EXHIBITING BISTABILITY AND DIFFERENTIAL GAIN Ph.D. Thesis

T. N. C. Venkatesan 1977 160 p

Avail: Univ. Microfilms Order No. 77-19553

The theory and experiment of an optical element is reported which exhibits bistable transmission, differential gain, discriminator, limiter and clipper actions. In all the above modes of operation of this element, a weak optical signal into a third port can control the output of a stronger optical power into the device. Hence this device may play as significant a role in future optical signal processing as the transistor does in electrical communication today. The element utilizes the nonlinear refractive index and/or the nonlinear absorption of a medium inside a Fabry-Perot interferometer. In pursuit of a solid state device, an experiment was performed with ruby, using a CW ruby laser source specifically for this work. Unanticipated room temperature operation of the device revealed an overlooked contribution to the nonlinear refractive index. Excellent agreement between the theory and the experiment was seen. The device does not need any population inversion of the intracavity medium. Dissert. Abstr.

N78-14891 Pennsylvania Univ., Philadelphia.

THE ROLE OF SURFACE ELECTROMAGNETIC WAVES IN NONLINEAR OPTICAL PHENOMENA Ph.D. Thesis

Yung Jui Chen 1977 151 p

Avail: Univ. Microfilms Order No. 77-19835

A theory of Raman scattering by surface polaritons which takes into account the kinematic factors of the nonlinear interaction was developed. The use of surface electromagnetic (S-EM) waves to study the overlayers on metal surfaces resulted in enhancement of the fluorescence of a thin layer of Rhodamine 6 on silver as compared to that observed in a conventional external reflection configuration. The field enhancement which occurs when a S-EM wave is excited as the incident radiation at a metal-liquid benzene interface was quantitatively measured. Both the attenuation total reflection prism configuration, in which S-EM waves are excited as the incident and/or outgoing signal radiations, and the conventional external reflection configuration, in which volume EM waves are the incident and outgoing signal radiations are encompassed in an approach are given for the treatment of nonlinear optical phenomena. Dissert. Abstr.

N78-14892 Arizona Univ., Tucson.

ANALOG RECONSTRUCTION METHODS FOR TRANSAXIAL TOMOGRAPHY Ph.D. Thesis

Scott Kirkwood Gordon 1977 167 p

Avail: Univ. Microfilms Order No. 77-18665

A tomography system is described that uses fluorescent screens and film as a detector, which is equivalent to a very large, very high resolution array. With film the detector element size does not limit final resolution. The reconstruction is done with an analog version of the convolution algorithm implemented on an incoherent optical processor. The processor uses the geometry of a rotating cylinder to shift the data as required for the convolution. A pair of filter masks multiply the projection and the transmitted light is measured to perform the integrals. The analog method accomplishes a two-dimensional integral as one parallel operation so that the processing is very rapid even with slow electronics. Reconstructions are shown with a spatial resolution of about 2mm and a density resolution of about 1% of the absorption coefficient of water. The advantages of this method are a low cost, high resolution detector, and rapid processing. Dissert. Abstr.

N78-14893# National Research Council of Canada, Ottawa (Ontario).

ON THE THEORY OF THE REFLECTION AND TRANSMISSION OF LIGHT BY A THIN INHOMOGENEOUS DIELECTRIC FILM

L. Sossi and P. Kard 1977 12 p Transl. into ENGLISH from Izv. Akad. Nauk Est. SSR: Ser. Tekhn. i Fiz. Mat. (USSR), v. 17, no. 1, 1968 p 41-48

(NRC/CNR-TT-1905; ISSN-0077-5606) Avail: NTIS HC A02/MF A01

The solution of the Riccati equation, defining the reflection coefficient for monochromatic light of a thin inhomogeneous dielectric layer, is represented as a ratio of two infinite series which are shown to converge. The transmission coefficient is also expressed in terms of one of these series. A numerical example where the third approximate solution agrees with the exact solution within an error of 0.002 or less is included.

Author

N78-14894# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

BOUNDARY DETECTION IN IMAGES: OPTICAL FORMULATION IN TERMS OF SIGNAL DETECTION THEORY M.S. Thesis [DETECCAO DE BORDAS EM IMAGENS: FORMULACAO EM TERMOS DE TESTES DE HIPOTESES]

Lucila Olivia DaCostaPrado Sep. 1977 147 p refs In PORTUGUESE; ENGLISH summary

(INPE-1118-TPT-067) Avail: NTIS HC A07/MF A01

Statistical techniques for the boundary detection problem are developed for application to pictures taken by land resources satellites. The image is modeled by signal and noise which are independent, additive, Gaussian and autoregressive in two dimensions. The parameters of the model are determined by correlation measurements. The optimal formulation in terms of signal detection theory leads to the construction of a test which involves seven overlapping hypothesis. A computationally attractive suboptimal test, involving non-overlapping hypothesis is developed. Simulation results of the algorithm, when applied to groups of four pixels of the image are included. Author

N78-14895# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.

SOME RESULTS OF TESTS ON THE HELICOPTER-TANK AND TANK-HELICOPTER VISIBILITY UNDER IDEALIZED CONDITIONS

H.-E. Hoffmann and R. H. Buell 11 Jun. 1975 35 p refs In GERMAN; ENGLISH summary

(DLR-IB-553-75/9) Avail: NTIS HC A03/MF A01

The maximum detection range and the maximum recognition range air-to-ground and ground-to-air were determined. A Leopard tank, a radio truck, and a special test board were oberved from a Bell UH 1D helicopter and a Do 27 airplane. The maximum detection range ground-to-air was between 6 and 12 km larger than the maximum detection range air-to-ground. For the maximum detection range ground-to-air values between 9 and 16 km and for the maximum detection range air-to-ground values between 2 and 4 km were obtained. The maximum recognition range air-to-ground was up to 2 km smaller than the maximum detection range. At observation of the special test board the maximum detection range was smaller than the obervation of the radio truck. The tests took place at horizontal standard visibilities between 36 and 57 km. Author (ESA)

N78-14896# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.

HORIZONTAL STANDARD VISIBILITY, DETERMINED BY CONTRAST MEASUREMENTS OF NATURAL TARGETS, AND VISUAL RANGE DURING TEST CAMPAIGNS IN SOUTHERN GERMANY [DIE HORIZONTALE NORMSICHT, ERMITTELT DURCH KONTRASTMESSUNGEN AN NATUERLICHEN SICHTZIELEN, UND DIE VISUELLE SICHTWEITE BEI VERSUCHSKAMPAGNEN IN SUEDDEUTSCHLAND]

H.-E. Hoffmann and W. Kuehnemann 21 Jul. 1976 36 p refs In GERMAN; ENGLISH summary

(DLR-IB-553-76/2) Avail: NTIS HC A03/MF A01

The horizontal standard visibility was determined by measuring the contrast of natural targets during test campaigns conducted to define the visibility of air and ground targets. Visual ranges were determined simultaneously to find out to which extent this horizontal standard visibility represented the degree of opacity of the atmosphere. The visual range is the distance at which natural targets with contrast limit can be seen. Half of the measured and observed results corresponded with each other in one of the test areas. Here, edges of forests were used for determination of the visual range. A possible explanation for this phenomenon is a too low value of the contrast threshold on which the calculation of standard visibility was based. Better correspondence was obtained for a test area with wooded hills, representing a target with a large effective area. Author (ESA)

N78-14897# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.

OPTICAL RANGE, TARGET RECOGNITION [SICHTWEITE, ERKENNBARKEIT VON ZIELEN]

G. H. Ruppersberg 16 Dec. 1976 16 p refs In GERMAN Conf. held at Bundesakad. fuer Wehrverwaltung u. Wehrtech., Mannheim-Neuostheim, West Ger., 16 Dec. 1976

(DLR-IB-553-77/1) Avail: NTIS HC A02/MF A01

The interaction of several factors related to the optical range phenomenon is represented according to Duntley's modern derivation. The theory covers the optical slant range problem; Koschmieder's theory of horizontal range appears as a special case. The standard optical range also results; this is the range corresponding to the meteorological optical range during daytime. Practical indications can be given about the optical range of lights and objects under ideal observation conditions. These distances are generally boundary values for the visibility of the related targets under normal conditions. ESA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N78-14898 Washington Univ., Seattle.

PROPAGATION OF A TRAPPED LASER BEAM IN A PLASMA COLUMN Ph.D. Thesis

Jon Michael Chapman 1977 82 p

Avail: Univ. Microfilms Order No. 77-18322

The propagation of an axisymmetric laser beam in a plasma column having a radially parabolic electron density distribution is examined. First, an extended paraxial procedure is developed for the case of an axially uniform waveguide. It is shown that the essential feature of an alternate focusing and defocusing beam is retained, but that the intensity distribution is cumulatively modified at the focii and at the outer portions of the beam as compared to that of the paraxial case. Secondly, some general features of paraxial beam propagation are examined for the case of axially varying waveguides. It is shown that one effect resulting from a finite waveguide aperture is the appearance of a diffraction ring pattern in the beam's intensity distribution when this is examined at any occurring focus of the propagating beam. Finally, laser-plasma coupling is examined for the case when laser heating generates a density distribution that is radially parabolic near the axis and when the energy absorbed over a focal length of the plasma lens is small. Dissert. Abstr.

N78-14899 Cornell Univ., Ithaca, N. Y.

COMPUTER STUDIES OF THE CLASSICAL ONE COMPONENT PLASMA AND OF THE GROUND STATE OF QUANTUM SYSTEMS Ph.D. Thesis

David Matthew Ceperley 1976 133 p

Avail: Univ. Microfilms Order No. 77-18862

The two-particle correlation function for the classical one component plasma in the high density fluid phase is calculated from the correlation function of a short range reference potential, by a perturbation method based on the hypernetted chain equation. It is shown that the long wavelength correlations are correctly described by this method. The ground state of quantum systems and results are presented of Monte Carlo variational calculations for a simple model of neutron matter for three different inter-nuclear potentials. Exact Monte Carlo calculations were also

performed for the ground state of one of these systems, the Chester-Cochran Yukawa potential, with Bose statistics. The Metropolis Monte Carlo method was used to sample an antisymmetric wavefunction composed of a product of a Jastrow wavefunction and a Slater determinant. Dissert. Abstr.

N78-14900 Washington Univ., Seattle.
ANALYSIS OF A SLENDER SOLENOID PLASMA DURING THERMONUCLEAR BURN Ph.D. Thesis
Harvey Jack Willenberg 1976 213 p
Avail: Univ. Microfilms Order No. 77-78443

A numerical technique is presented which describes the development of magnetically-confined fusion products. The state of the alpha particles is represented in terms of their population density distributed among their possible orbits. The background plasma is modelled as a two-temperature fluid. The plasma fluid equations and the alpha particle Boltzmann equation are numerically computed in a self-consistent manner in a computer code, which is applied to a variety of fast solenoid and steady solenoid plasmas for several milliseconds following thermonuclear ignition. The results indicate that the fast solenoid configuration yields greater energy gain than the steady solenoid.
Dissert. Abstr.

N78-14901# Nagoya Univ. (Japan). Inst. of Plasma Physics.
DESTRUCTION OF MAGNETIC SURFACES NEAR A SEPARATRIX OF A STELLARATOR ATTRIBUTED TO PERTURBATIONS OF MAGNETIC FIELDS
Yukihiro Tomita, Yasuyuki Nomura, Hiromu Momota, and Ryohei Itatani Sep. 1977 26 p refs
(IPPJ-304) Avail: NTIS HC A03/MF A01 CSCL 20I

The destruction of magnetic surfaces in the vicinity of a separatrix of a stellarator and a torsatron is analyzed. Unperturbed magnetic surfaces formed by a straight helical current and a uniform magnetic field are assumed. Destruction of magnetic surfaces is attributed to perturbations of magnetic fields, which are assumed to be brought from toroidal effects of magnetic fields or discrete structure of magnetic coils, respectively. Analysis is based on stochasticity and the spread of a stochastic layer in the vicinity of the separatrix is calculated. Author

N78-14902# Nagoya Univ. (Japan). Inst. of Plasma Physics.
DAMPING OF RADIAL OSCILLATION OF A TOROIDAL PINCH PLASMA
Mikio Mimura Sep. 1977 34 p refs
(IPPJ-305) Avail: NTIS HC A03/MF A01 CSCL 20I

Damping of radial oscillation which is observed in the early phase of pinch discharges was studied in a toroidal pinch machine, STP-2. Because the experiment was carried out in the toroidal machine, the endloss effect could be ignored. The temporal evolution of the oscillation was measured with a diamagnetic loop, and the plasma temperature and density were obtained by laser scattering. The temperature varies from 5 to 30 eV, and the density from 2 x 10 to the the 15th power to 10 to the 16th power cu cm. The temperature dependence of the observed damping time is compared with the result calculated from MHD equations which include dissipation terms. The oscillation is shown to dampen because of resistivity at low temperature; ion viscous damping is dominant at high temperatures. Author

N78-14903# Oak Ridge National Lab., Tenn.
INTERNAL DISRUPTIONS IN TOKAMAKS
Bruce V. Waddell, G. L. Johns, J. D. Callen, and H. R. Hicks May 1977 37 p refs
(Contract W-7405-eng-26)
(ORNL/TM-5840) Avail: NTIS HC A03/MF A01

It is hypothesized that sawtooth oscillations are the result of a cyclic process in which the plasma core is resistively heated until the safety factor drops below unity, causing the m = 1 tearing mode to become unstable, to grow with an accelerating growth rate, and ultimately to flatten the electron temperature and safety factor profiles. A model based on this hypothesis compares favorably with experimental data from ORMAK in explaining (1) the rate at which a sawtooth rises, (2) the radial dependence of the precursor and main sawtooth oscillation amplitudes, (3) the accelerating growth of the m = 1 precursor oscillations, and (4) the repetition time of the sawteeth. ERA

N78-14904# Max-Planck-Institut fuer Plasmaphysik, Garching (West Germany).
GENERATION AND DYNAMICS OF RUNAWAY ELECTRONS IN TOKAMAKS
G. Fussmann Aug. 1976 33 p refs
(IPP-III/30) Avail: NTIS HC A03/MF A01

The different contributions to the dynamic friction of a fully ionized, multicomponent plasma in the suprathermal range including relativistic effects are discussed. It is found that Coulomb collisions are most important but relativistic effects become essential for electron energies above approximately 500 keV. The motion of suprathermal electrons in momentum space is investigated by means of the relativistic Fokker-Planck equation. Compared with Dreicer, a more complicated picture is found for the family of flow lines in momentum space even for the non-relativistic case. A simple relation for the runaway threshold energy is obtained, and the acceleration and deceleration of runaways are investigated. In addition, the production and losses of runaways in Tokamak discharges are discussed and the runaway density for some experimental conditions are estimated. On these basis of the considerations, no problems with runaways are expected for the JET experiment and the conceptual data of a fusion reactor. ERA

N78-14905# Kernforschungszentrum, Karlsruhe (West Germany).
SUPERCONDUCTOR TECHNOLOGY FOR FUSION MAGNETS
C. H. Dustmann, K. P. Juengst, P. Komarek, G. Krafft, H. Krauth, P. Maier, G. Ries, W. Schauer, C. Schmidt, E. Seibt et al Nov. 1976 147 p refs In GERMAN; ENGLISH summary
(KFK-2359) Avail: NTIS HC A07/MF A01

The parameters of a big Tokamak magnet system are presented and the resulting constraints for the conductor are given. Comparing these constraints with the state of the art of the magnet and conductor technology, the goals of the needed conductor development are defined. Existing conductor concepts are described. Based on considerations on the main problems (cooling concepts, mechanical stress analysis, stabilization, ac-losses) a concept of an economically feasable and cryogenically stabilized flat cable conductor is developed. Typical parameters of a 10 kA conductor with NbTi at 8 T are given. The experimental investigations needed for the conductor development are discussed. Existing devices for measurements of I sub(c), ac-losses and the behavior of the conductor under mechanical stress are described. The construction of a versatile conductor test facility is proposed. ERA

N78-14906# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
ELEMENTARY DERIVATION OF THE KINETIC EQUATION FOR THE TWO-DIMENSIONAL GUIDING CENTER PLASMA
Michael Mond and Georg Knorr Apr. 1977 34 p refs
(Contract EY-76-S-02-2059)
(U-of-Iowa-77-17) Avail: NTIS HC A03/MF A01

A kinetic equation for a two dimensional inviscid hydrodynamic fluid is derived in two ways. First, the equations of motion for the modes of the fluid are interpreted as stochastic equations resembling the Langevin equation. To lowest order a Fokker-Planck equation can be derived which is the kinetic equation for one mode. Second, a suitable interaction scheme is applied to the Hopf equation which results in the same kinetic equation. A parameter describing the time scale is arbitrary and cannot be determined by the applied methods alone. It is shown that the kinetic equation satisfies the conservation requirements and relaxes to an equilibrium which is a rigorous solution of the Hopf equation. ERA

N78-14907# Illinois Univ., Urbana.
STUDIES OF THE STABILITY OF A FUSION BURN IN A REVERSED FIELD PINCH DEVICE
Helen Rosalinde Standeven Stimpson 1977 47 p refs
(Contract EY-76-S-02-2218)
(COO-2218-78) Avail: NTIS HC A03/MF A01

The burn of a plasma contained in a reversed field toroidal configuration and various prospective methods of prolonging the duration of a stable burn are examined. Extension of the stable period is desirable since a longer burn leads to greater energy

multiplication, Q. Results show that variations in normal operating parameters have only small effects on the length of the burn. Consequently, in order to achieve longer operating cycles with attractive Q values (Q approximately greater than 5), a positive control system such as cold fuel injection appears to be necessary. ERA

N78-14908# California Univ., Livermore. Lawrence Livermore Lab.
NUMERICAL SOLUTION OF THE FOKKER-PLANCK EQUATIONS FOR A MULTI-SPECIES PLASMA
J. Killeen and A. A. Mirin 11 Mar. 1977 26 p refs Presented at Coll. in Theoretical and Computational Plasma Phys., Trieste, Italy, 22 Mar. 1977
(Contract W-7405-eng-48)
(UCRL-79275; Conf-770329-1) Avail: NTIS HC A03/MF A01

Two numerical models used for studying collisional multispecies plasmas are described. The mathematical model is the Boltzmann kinetic equation with Fokker-Planck collision terms. A one-dimensional code and a two-dimensional code, used for the solution of the time-dependent Fokker-Planck equations for ion and electron distribution functions in velocity space, are described. The required equations and boundary conditions are derived and numerical techniques for their solution are given. ERA

N78-14909# California Univ., Livermore. Lawrence Livermore Lab.
EFFECTS OF FLOW ON DENSITY PROFILES IN LASER IRRADIATED PLASMAS
Claire E. Max and C. F. McKee 19 Apr. 1977 15 p refs Presented at 7th Ann. Symp. on the Anomalous Absorption of Intense High Frequency Waves, Ann Arbor, Mich., 18 May 1977
(Contract W-7405-eng-48)
(UCRL-79392; Conf-770538-1) Avail: NTIS HC A02/MF A01

It is shown that steady state density profiles at the critical density may be divided into three categories, depending on the plasma outflow velocity relative to the critical surface. Flows which are sufficiently subsonic produce ordinary profile-steepening. Velocities which are sufficiently supersonic result in a shock-like compression near the critical surface. A range of intermediate flow velocities has no solutions for a steady-state profile. ERA

N78-14910# California Univ., Livermore. Lawrence Livermore Lab.
EXPERIMENTAL INVESTIGATION OF THE TRAPPING AND ENERGY LOSS MECHANISMS OF INTENSE RELATIVISTIC ELECTRON RINGS IN HYDROGEN GAS AND PLASMA
Adrian Charles Smith, Jr. 25 Apr. 1977 333 p refs
(Contracts W-7405-eng-48; EY-76-S-02-2319)
(UCID-17438-Vol-2) Avail: NTIS HC A15/MF A01

The trapping and confinement of electron rings in preionized media, neutral gases, and plasma is discussed. ERA

N78-14911# Princeton Univ., N. J. Plasma Physics Lab.
STUDIES OF TOKAMAK FUSION REACTOR DYNAMICS Final Report, 1 Jun. 1975 - 31 Jan. 1977
R. G. Mills and S. L. Gralnick 1977 79 p
(Contract EY-76-S-02-2735)
(COO-2735-2) Avail: NTIS HC A05/MF A01

Time dependent phenomena associated with the inherently pulsed nature of the Tokamak fusion reactor was investigated. A multi-node point kinetics computer code was developed in which the plasma is viewed as a set of conductors inductively coupled to one another and to a system of poloidal field coils. This code incorporates aspects of both the plasma equilibrium problem as well as the diffusion problem. A detailed introduction to the subject of Tokamak reactor dynamics is given. ERA

N78-14912# Los Alamos Scientific Lab., N. Mex.
PROPOSED TOKAMAK POLOIDAL FIELD SYSTEM DEVELOPMENT PROGRAM
J. D. Rogers, H. F. Vogel, R. W. Warren (Westinghouse Elec. Corp., Pittsburg, Pa.), and D. M. Weldon May 1977 93 p refs
(Contract W-7405-eng-36)
(LA-6811-P) Avail: NTIS HC A05/MF A01

A program is proposed to develop poloidal field components for TNS and EPR size Tokamak devices and to test these components in realistic circuits. Emphasis is placed upon the development of the most difficult component, the superconducting ohmic-heating coil. Switches must also be developed for testing the coils, and this switching technology is to be extended to meet the requirements for the large scale Tokamaks. Test facilities are discussed; power supplies, including a homopolar to drive the coils, are considered; and poloidal field systems studies are proposed. ERA

N78-14913# Japan Atomic Energy Research Inst., Tokyo.
FREQUENCY CHARACTERISTICS OF THE HORIZONTAL MOTION OF A JT-60 PLASMA COLUMN
Yuichiro Kambayashi Apr. 1976 114 p refs
(JAERI-M-6508) Avail: NTIS (US Sales Only) HC A06/MF A01; ERDA Depository Libraries

After briefing the kinetics model for the horizontal displacement of a toroidal plasma column in the Tokamak device, frequency characteristics of the horizontal motion of a JT-60 plasma column are described, especially, influence of the uncertainty of parameters on the characteristics. ERA

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N78-14914 Oregon Univ., Eugene.
THE DE HASS-VAN ALLPHEN MEASUREMENTS OF SCATTERING IN THE Rh-Fe MAGNETIC IMPURITY SYSTEM Ph.D. Thesis
Ling-Shen Cheng 1977 144 p
Avail: Univ. Microfilms Order No. 77-19332

The RhFe dilute alloy system showed an unusual magnetic impurity behavior whose electrical resistivity remained a positive temperature dependence down to about 0.02 K. Explanations proposed include: the presence of several bands of differing wave function symmetry; the simultaneous presence of spin and potential scattering; a temperature dependent occupation of the spin up/down impurity band, and localized spin-fluctuation scattering. However, the problem is that several such models equally well describe the gross feature of bulk measurements, but involve very different pictures of the underlying microscopic state. The dHvA effect (Landau quantum oscillations of the magnetic susceptiblity) offers an opportunity to explore the microscopic origin of the phenomenon. We report the measurement of scattering lifetimes on several sheets of the Fermi surface (using the dHvA amplitudes), and the measurements of orbital g-factor and spin-dependent scattering (using the dHvA waveshape). Dissert. Abstr.

N78-14915 British Library Lending Div., Boston Spa (England).
FORMATION OF DEPOSITS OF SILICON NITRIDE THIN FILMS OBTAINED BY CHEMICAL REACTION IN A RF LOW DISCHARGE
G. Turban and Y. Catherine Mar. 1977 19 p refs Transl. into ENGLISH from Thin Solid Films (Netherlands), v. 35, no. 2, 15 Jun. 1976 p 179-194
(BLL-Trans-3421-(9022.81)) Avail: British Library Lending Div., Boston Spa, Engl.

Thin films of silicon nitride were deposited in a low pressure r.f plasma, the continuous reactant flow being a mixture of silane and nitrogen. The growth rates of the films were studied as a function of several parameters governing the electrodeless discharge. The chemical reation yield was obtained by collecting the deposit along the tube length. The conditions for powder deposition were also investigated. Author

N78-14916 Virginia Polytechnic Inst. and State Univ., Blacksburg.
DYNAMICS OF THE DOUBLE LAYER AT THE POLARIZABLE MERCURY-ELECTROLYTE INTERFACE Ph.D. Thesis
Soli S. Bamji 1977 85 p

Avail: Univ. Microfilms Order No. 77-20218

By choosing a model for the moving electrolyte-mercury-electrolyte system, the maximum output voltage (which is mathematically the potential difference across a single interface) is obtained when the back end of the moving mercury drop becomes a hemisphere and the front end becomes a flat circular disc. The U-effect 2 and the U-effect 3 are essentially the manifestations of the same effect namely, that the output voltage is due to the distortion of the surface areas of the two ends of the moving mercury drop while the number of dipoles across each interface remains fixed. The output voltage is dependent on the velocity and the acceleration of the mercury drop and not on the relative displacement of this drop with respect to the capillary wall. The dependence of the output voltage on the acceleration of the mercury drop is opposite to that of the velocity. Dissert. Abstr.

N78-14917 Pennsylvania Univ., Philadelphia.
SURFACE EM WAVES AND SPECTROSCOPY IN ATTENUATED TOTAL REFLECTION (ATR) CONFIGURATIONS Ph.D. Thesis
Wenpeng Chen 1977 191 p
Avail: Univ. Microfilms Order No. 77-19834

The study of surface EM waves and spectroscopy in ATR prism configuration was carried out using both an icident plane wave and a finite incident beam. Surface EM waves were excited in a Kretschmann (prism-metal-air) configuration in the visible and in an Otto (prism-air-metal) configuration in the infrared. In the case of excitation of surface EM waves in the visible, the scattering of volume EM waves into surface EM waves by surface acoustic waves and the corresponding scattering of surface EM waves into volume EM waves were observerd for the first time. The surface acoustic waves were generated on an optically polished LINBO3 plate with Ag-film on the surface, and the prism served for the generation and the detection of surface EM waves. Dissert. Abstr.

N78-14918 Stanford Univ., Calif.
SPIN WAVES IN NARROW BAND SYSTEMS Ph.D. Thesis
Brian John Bell 1977 84 p
Avail: Univ. Microfilms Order No. 77-18197

The perturbation expansion techniques of a many-body theory were used to examine the excitation spectrum of a half-filled narrow band system near the Mott transition, by calculating the appropriate semi-invariant (a function that depends on the correlations induced by electron-electron interactions at a given site). The single particle excitations of the system the Spin-wave spectrum for the system were calculated, and fluctuations of the ground state were included. The validity and accuracy of the calculation were estimated by comparing the results to an exact calculation that is valid in one dimension. The agreement is found to be good. The properties of NiS are discussed in relation to a one dimensional band system. Dissert. Abstr.

N78-14919 Stanford Univ., Calif.
A STRUCTURAL STUDY OF AMORPHOUS COPPER-ARSENIC TRISELENIDE ALLOYS USING EXAFS Ph.D. Thesis
Sally Janet Herbert Hunter 1977 148 p
Avail: Univ. Microfilms Order No. 77-18219

Atomic arrangements in amorphous alloys of Cu in As2Se3 were studied using Extended X-Ray Absorption Fine Structure (EXAFS) and a detailed structural model for the glasses was developed. Previous structural studies of this system using X-ray diffraction radial distribution functions (RDF) had determined the average near neighbor coordination numbers and distances for average atoms in these glasses. In an effort to obtain these coordination numbers, studies of EXAFS were initiated. EXAFS is the oscillatory portion of the X-ray absorption coefficient on the high energy side of the X-ray absorption edge. Theoretical analyses indicate that the amplitudes and frequencies of the oscillations are directly related to coordination numbers and coordination distances, respectively, of the atom whose absorption edge is being studied, rather than of an average atom. Dissert. Abstr.

N78-14920 Rice Univ., Houston, Tex.
MAGNETOELASTIC CONTRIBUTIONS TO THE ELASTIC CONSTANTS OF DYSPROSIUM Ph.D. Thesis
Billy Michael Kale 1977 283 p
Avail: Univ. Microfilms Order No. 77-19268

The elastic constants C22, C33, C44, and C66 of dysprosium single crystals were determined experimentally as functions of the magnetization. Measurements of the elastic wave velocities in applied fields of 0-75kOe mainly in the temperature range, 180K-300K were used to calculate the elastic constants from the second derivatives of the internal energy with respect to the dynamic strain. The experimental dependences of the elastic constants on the magnetization are fit to the derivatives of the internal energy, and the coefficients that are thus determined are related to the magnetoelastic constants. In principle, all ten of the second-order magnetoelastic constants can be determined. The experimental measurements and the best least squares fit to them are presented, and the magnetoelastic constants are compared to those calculated from the static magnetostriction. Dissert. Abstr.

N78-14921 Northeastern Univ., Boston, Mass.
MICROSCOPIC THEORY OF PHONON SPECTRA IN NORMAL SOLIDS Ph.D. Thesis
Constantinos Efstratiou Paraskevaidis 1976 118 p
Avail: Univ. Microfilms Order No. 77-17792

A theory of lattice dynamics is developed for a normal solid considered as a many-body system of interacting nuclei and electrons. The nuclei are taken to move about some equilibrium positions with small amplitudes (harmonic approximation), while the electrons are unrestricted, i.e., the adiabatic, or Born-Oppenheimer, approximation is not made. Within the harmonic approximation the response function obeys a closed equation, in which the full influence of the electrons is rigorously described by their dielectric function, (or susceptibility, or conductivity). This result, which is not restricted by the adiabatic approximation, is valid for all normal solids, insulators, metals, semiconductors, or semimetals. The two-band model of such a general solid demonstrates that acoustic phonons for small wave vectors can always exist beyond the adiabatic approximation. Dissert. Abstr.

N78-14922 Washington Univ., Seattle.
A HIGH PRESSURE STUDY OF THE SUPEREXCHANGE INTERACTION IN FeF2 Ph.D. Thesis
Graham Anthony Garcia 1977 123 p
Avail: Univ. Microfilms Order No. 77-18347

A Mossbauer effect measurement of the pressure dependence of the Neel temperature in FeF2 is reported. The usual difficulties associated with Mossbauer absorber studies at high pressure were avoided by an arrangement of the source and absorber. By placing the source in physical contact with the absorber, only the zero Doppler shift component of the Mossbauer spectrum was observed. As the temperature was scanned through the paramagnetic to antiferro-magnetic phase transition, T(N) was indicated by an abrupt change in the transmitted count rate. This technique, particularly suited to high pressure work, was applied to FeF2 up to pressures of 50 kbar. The Neel temperature was found to increase linearly at the rate of 0.27 + or - 0.03 K/kbar. Dissert. Abstr.

N78-14923# Northrop Research and Technology Center, Hawthorne, Calif.
IONIZING RADIATION EFFECTS ON SILICON-ON-SAPPHIRE DEVICES AND SILICON DIOXIDE FILMS Final Report, May 1976 - Apr. 1977
Joseph R. Srour, Siegfried Othmer, Orlie L. Curtis, Jr., Kuang Y. Hiu, and Susan C. C. Chen Aug. 1977 208 p refs
(Contract DAAG39-76-C-0090)
(AD-A046169; NRTC-77-28R; HDL-CR-77-090-1) Avail: NTIS HC A10/MF A01 CSCL 18/6

This report describes results of several related studies of ionizing radiation effects on silicon-on-sapphire devices and on silicon dioxide films. In the SOS investigation, emphasis was placed on the study of radiation-induced back-channel leakage current and on a comparison of devices with wet and dry gate oxides. Differing behavior for wet and dry devices is accounted for in terms of a larger density of hole traps in the sapphire for dry transistors as compared to wet units. SEM studies reveal that energy must be deposited in the sapphire before significant increases in leakage current will occur. In addition, such studies indicate that energy deposition deep in the sapphire bulk is

relatively unimportant in producing leakage current. A process of radiation-induced reduction of leakage current was observed in which this current can be dramatically reduced to near its pre-irradiation value by simply reducing the applied drain bias to zero and continuing the irradiation. Models for radiations effects on SOS devices are presented. Measurements of the temporal, temperature, and electric-field dependencies of radiation-induced charge transport have been performed for radiation-hardened SiO2 films. GRA

N78-14924# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EFFECT OF NEUTRON RADIATION ON THE ELASTIC MODULI OF GALLIUM ARSENIDE

N. N. Sirota and N. F. Kurilovich 31 May 1977 14 p refs Transl. into ENGLISH from Dokl. Akad. Nauk (Moscow), v. 20, no. 11, 1976 p 978-981

(AD-A045934; FTD-ID(RS)T-0838) Avail: NTIS HC A02/MF A01 CSCL 20/2

Up to now virtually no studies have been made on the effect of radiation on the elastic properties of gallium arsenide. Moreover, interest in electronic equipment and quantum electronics has made it necessary to conduct systematic studies in this area. The elastic moduli, which are important characteristics of crystals, determine many of their properties; they are uniquely related to the crystal structure and the nature and energies of interatomic interactions. Author (GRA)

N78-14925# California Univ., Berkeley. Lawrence Berkeley Lab.

DEVELOPMENT AND APPLICATIONS OF THE TUNNEL JUNCTION dc SQUID Ph.D. Thesis

M. B. Ketchen May 1977 199 p refs

(Contract W-7405-eng-48)

(LBL-6086) Avail: NTIS HC A09/MF A01

The discussion is divided into three principle areas. Chapters II through VII are concerned with the theory, fabrication, operation, and performance of thin-film tunnel junction dc SQUID (Superconducting QUantum Interference Device). Chapters VIII, IX, and X describe the development of a planar dc SQUID and the incorporation of this SQUID into thin-film magnetic field gradiometers. Chapters XI through XIII discuss the application of a cylindrical dc SQUID to the measurement of thermal fluctuations in freely-suspended tin fibers at the superconducting transition. ERA

N78-14926# Sandia Labs., Albuquerque, N. Mex.

CHANNELING ANALYSIS OF STACKING DEFECTS IN EPITAXIAL Si LAYERS

S. U. Campisano, G. Foti, and E. Rimini 1977 21 p refs Presented at 3d Intern. Conf. on Ion Beam Analysis, Washington, D. C., 27 Jun. 1977

(Contract EY-76-C-04-0789)

(SAND-77-0478C; Conf-770642-1) Avail: NTIS HC A02/MF A01

The channeling effect technique has been applied to investigate dechanneling by stacking defects in heteroepitaxially grown silicon. Ion backscattering was performed on 0.9 micrometer Si layers grown on sapphire as a function of beam energy (1.1 to 2.5 MeV He+), projectile ion (He+, D+) and crystal direction ([100], [111], [112], [113],). A model based on the new interior surfaces presented by such stacking defects is used to calculate the dechanneling cross section, and the disorder profiles are obtained from the experimental dechanneled fractions in terms of displaced rows per unit volume. Direct backscattering of channeled particles from the defects is neglected since the dechanneling cross section per row is about one order of magnitude larger than that per displaced atom. The resulting defect depth distributions are independent of beam energy and projectile ion, and give improved quantitative agreement with previous studies. The application of channeling to stacking-defect measurements requires a minimum density of approximately 10 to the 15th power displaced rows/sq cm. ERA

N78-14927# Ames Lab., Iowa.

EXCITATION TEMPERATURE AND ELECTRON NUMBER DENSITY DISTRIBUTIONS EXPERIENCED BY ANALYTE SPECIES IN AN INDUCTIVELY COUPLED ARGON PLASMA Ph.D. Thesis

Dennis James Kalnicky Feb. 1977 225 p refs

(Contract W-7405-eng-82)

(IS-T-737) Avail: NTIS HC A10/MF A01

Spatially resolved, radial excitation temperatures and radial electron number density distributions experienced by analyte species in the observation zone of 15 to 25 mm above the load coil of a toroidally shaped, inductively coupled argon plasma (ICP) are presented and related to the analytical performance of these plasmas. A comparison of radial temperatures measured with support gas (Ar I) lines and with a typical analyte thermometric species (Fe I) at 15 mm above the load coil is given. Radial (Fe I) excitation temperatures obtained at three observation heights (15, 20, and 25 mm) are compared for aerosol carrier gas flows of 1.0 1/min and 1.3 1/min. A comparison of radial electron number density distributions measured by the Saha-Eggert ionization and Stark broadening methods is given for an observation height of 15 mm above the load coil. The differences between the electron number density values obtained by these methods is discussed. ERA

N78-14928# Lyon Univ. (France). Inst. de Physique Nucleaire.

LIGAND FIELD PARAMETERS FOR Eu(3+) IN REVO4 (RE = Gd, Y, AND Lu)

G. Grenet, M. Kibler, C. Linares, A. Louat, and F. Gaume 4 Feb. 1977 8 p refs

(LYCEN-7710) Avail: NTIS HC A02/MF A01

Absorption and fluorescence spectra of REVO4 are described by phenomenological parameters. Ligand field parameters are determined by taking J-mixing (which arises form the introduction of the ligand field interaction onto the ground term F-7 of Eu(3+)) into account. These parameters are discussed within the framework of the angular overlap model involving sigma, pi, delta, and phi effects. Author (ESA)

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N78-14929 State Univ. of New York, Stony Brook.

NONSTANDARD ANALYSIS AND RIGOROUS STATISTICAL MECHANICS. TWO THERMODYNAMIC LIMIT PROBLEMS Ph.D. Thesis

Arnold Milton Ostebee 1977 60 p

Avail: Univ. Microfilms Order No. 77-20034

Two thermodynamic limit problems from rigorous statistical mechanics are discussed using nonstandard analysis. It is shown that for overall neutral systems of charged particles in which a weakly tempered interaction is present in addition to the Coulomb interaction the free energy per unit volume has a limit when the volume of the system tends to infinity. It is also shown that the infinite volume correlation functions exist and are analytic functions of the fugacity for dilute systems. Dissert. Abstr.

N78-14930# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).

SPECTRAL AND SCATTERING THEORY OF THE SCHROEDINGER EQUATION FOR THREE-BODY SYSTEMS

J. Ginibre Oct. 1976 38 p refs Presented at the Symp. commemorating the 50th Anniv. of the Schroedinger Equation, Vienna, 10-12 Jun. 1976

(LPTHE-76/19) Avail: NTIS HC A03/MF A01

The status of the spectral and scattering theory of the nonrelativistic quantum mechanical three-body problem is reviewed with special emphasis on the work of Faddeev and his followers, based on the Faddeev equations. Author (ESA)

N78-14931# Paris Univ. (France). Lab. de Physique Theorique des Liquides.

CHARGED HARD SPHERES IN A UNIFORM NEUTRALIZING BACKGROUND: COMPARISON OF MONTE CARLO RESULTS WITH PERTURBATION THEORIES

J. P. Hansen and J. J. Weis (Lab. de Phys. Theorique et Hautes Energies, Orsay, France) Nov. 1976 17 p refs

(LPTHE-76/26) Avail: NTIS HC A02/MF A01

Monte Carlo computations for the thermodynamic properties and pair distribution function of a one-component system of charged hard spheres in a uniform neutralizing background are compared with perturbation theories. These are the mixed integral equation approach proposed by Lado, the exponential approximation of Andersen and Chandler, a higher order cluster expansion approximation due to Stell and Verlet and Weis, and the mean spherical approximation (MSA). It is shown that, while none of these approximations gives satisfactory results for the pair distribution function, both the MSA and the mixed integral equation approach give internal energies in excellent agreement with the Monte Carlo results. Author (ESA)

N78-14932# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).

QUANTUM EFFECTS AT TRANSLATION AND ROTATION RELAXATION IN GAS EXPANSIONS Ph.D. Thesis - Goettingen Univ., West Ger. [QUANTENEFFEKTE BEI DER TRANSLATIONS- UND ROTATIONSRELAXATION IN GASEXPANSIONEN]

Klaus Winkelmann Mar. 1977 157 p refs In GERMAN

(MPIS-11/1977) Avail: NTIS HC A08/MF A01; Max-Planck-Inst. fuer Stroemungsforsch., Goettingen, West Ger. DM 26,40

High expanded molecular beams of monoatomic and diatomic particles were studied using the quantum mechanical systems helium and hydrogen. For the monoatomic case a theoretic model based on the publications of Knuth and Fisher, and Miller and Andres, is described. The high speed ratio for helium, caused by null energy resonance could only be explained quantum mechanically. The lower limit of the helium integral potential parameter scattering length is 25 A. In high expanded hydrogen nozzle beams the asymptotic values of the rotation temperature, flow velocity, and velocity ratio were measured. The velocity ratio was up to 85 and the rotation temperature about 130 K. Velocity distributions of pure parahydrogen nozzle jets were also measured. There was little difference with the values measured for normal hydrogen. The results were explained quantitatively, using quantum mechanics. ESA

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N78-14933 British Library Lending Div., Boston Spa (England).

PROJECT MANAGEMENT FOR MEDIUM-SIZE UNDERTAKINGS: A MEANS OF ACHIEVING A MORE COMPETITIVE STATUS

E. Venten Oct. 1977 9 p refs Transl. into ENGLISH from Brau Industrie (West Germany), v. 62, no. 5, 1977 p 203-206

(BLL-RTS-10949) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

The ways in which project management can be used in medium and small-sized undertakings are outlined. Characteristics pertinent to projects are given and a description is given of project management. Finally a functional analysis is presented of project management for medium-sized undertakings. L.S.

N78-14934 Stanford Univ., Calif.

A PROXY APPROACH TO MULTI-ATTRIBUTE DECISION MAKING Ph.D. Thesis

Kenneth R. Oppenheimer 1977 123 p

Avail: Univ. Microfilms Order No. 77-18233

The desirable features of the global and local techniques are combined in a new improved method. The normatively motivated preference models of the global procedure are incorporated as proxy functions in a local procedure. These proxies are better models of the true objective than are the linear approximations, so the resulting trial sequence reaches the optimum much faster. The new proxy approach yields rapid convergence without restrictive assumptions. After the theoretical aspects of the proxy approach are developed, the new algorithm is applied to a curriculum planning problem. This practical application was successful; the decision maker, previously unfamiliar with decision analysis, was able to provide the assessments required at each iteration. With the help of various consistency tests, the tradeoff assessments generated trial solutions that converged rapidly to the optimal solution.

Dissert. Abstr.

N78-14935# Office of Telecommunications, Annapolis, Md.

PROBABILISTIC APPROACHES IN SPECTRUM MANAGEMENT

David J. Cohn Aug 1977 36 p refs Sponsored by Office of Telecommunications Policy, Wash., D. C.

(PB-272424/3; OTR-77-127) Avail: NTIS HC A03/MF A01 CSCL 17B

The application of a general probabilistic approach as an alternative to a worst case analysis in spectrum management problems is assessed. Noise models which describe probabilistic environments include interfering sources emitting randomly and independently in space and time. The received noise is conveniently typed into several classes, depending upon the emission spectra of the noise and the receivers employed. Predictions of the performance of selected suboptimum digital receiver structures for these non-gaussian noise environments are discussed. The N-link telecommunications environment is examined as well as potential applications for interference analysis of the large scale interacting systems. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N78-14936+ Royal Aircraft Establishment, Farnborough (England).

LIST OF RAE TRANSLATIONS ISSUED DURING THE PERIOD JANUARY 1976 - DECEMBER 1976

Margaret Bromley, comp. Mar. 1977 13 p refs

(RAE-Lib-Bib-360; BR58188) Copyright. Avail: NTIS HC A02

A summary of each translated document is given. ESA

N78-14937# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

ANALYTICAL MODEL FOR INFORMATION FLOW: A MODEL FOR DESIGN AND CONSTRUCTION OF SELF-INSTRUCTIONAL MATERIALS M.S. Thesis [MODELO DE ANALISE DO FLUXO DE INFORMACOES: UM MODELO PARA O DESENVOLVIMENTO DE MODULOS DE INSTRUCAO INDIVIDUALIZADA PARA O APRENDIZADO DE TECNICAS]

Claudio Benedito Gomide deSouza Oct. 1977 84 p refs In PORTUGUESE; ENGLISH summary

(INPE-1127-TPT/068) Avail: NTIS HC A05/MF A01

Difficulties yet to be overcome in the area of techniques teaching are discussed. The teaching-learning process is then conceived as the integration of objectives, activities, resources, and evaluation mechanisms. From this point of view, a model

for design and construction of self-instructional materials is defined. Having been theoretically defined, the model is then applied in the specific area of 'decision analysis', placing the emphasis on the nature of the process and its replicability. The result of this application is the Decision Analysis Instructional Package, which is an instructional materials set programmed for teaching that technique. Finally, results from an application of the package on a sample of potential consumers are interpreted. Author

N78-14938# Mitre Corp., McLean, Va. METREK Div.
AN AUTOMATED INFORMATION DIRECTORY SYSTEM (AIDS) REVIEW AND SPECIFICATIONS
M. P. Munkassey, M. L. Noonchester, and D. F. OSullivan Jul. 1977 166 p refs Sponsored by DOT, Wash., D. C.
(PB-272253/6; MTR-7571) Avail: NTIS HC A08/MF A01 CSCL 17B

An Automated Information Directory System (AIDS) is intended to provide assistance to transit systems by disseminating transit information to patrons by telephone. Presented are the performance and technical specifications for AIDS, and Urban Mass Transportation Administration-sponsored project, to be demonstrated and evaluated in service at the Washington Metropolitan Area Transit Authority. The objective of this demonstration is to develop and evaluate a usable and effective computer aided transit information system that can be used throughout the United States, particularly where properties operate a complex transit network. GRA

N78-14939# Gellman Research Associates, Inc., Jenkintown, Pa.
THE ROLE OF SCIENTIFIC AND TECHNICAL INFORMATION IN CRITICAL PERIOD MANAGEMENT, VOLUME 1 Final Report
May 1977 152 p refs
(Contract NSF 76-05499)
(PB-272178/5) Avail: NTIS HC A08/MF A01 CSCL 05A

The role of scientific and technical information in the resolution of domestic crises was examined. A study was designed to be an exploratory effort, which would provide insight into the use of scientific and technical information and develop hypotheses which could be employed in future experiments or analyses. The method used to conduct the studies included the preparation and analysis of four ex post case histories of domestic crises. The crises examined include: (1) Penn Central bankruptcy, (2) Oil Embargo of 1973-74, (4) Emergency blackout of September 20, 1970 in parts of New York City; and (4) the Apollo 13 incident. Author

N78-14940# Gellman Research Associates, Inc., Jenkintown, Pa.
THE ROLE OF SCIENTIFIC AND TECHNICAL INFORMATION IN CRITICAL PERIOD MANAGEMENT, VOLUME 2 Final Report
May 1977 389 p refs
(Contract NSF 76-05499)
(PB-272179/3) Avail: NTIS HC A17/MF A01 CSCL 05A
For abstract, see N78-14939.

N78-14941# National Classification Management Society, Inc.
CLASSIFICATION MANAGEMENT, JOURNAL. VOLUME 12, NUMBER 2, 1977
1977 135 p Papers from the 12th National Seminar, 20-22 Jul. 1976
(AD-A046264) Avail: NTIS HC A07/MF A01 CSCL 05/2

Partial contents: The Interagency Classification Review Committee in Action; Information Security--Past, present and future; Department of Defense Panel; The Expanding Role of Industrial Security; Effects of Information Security Requirements in Technical Libraries; The Impact of FOIA and Privacy Acts on an Intelligence Agency--CIA; Intelligence and Evolving Classification Guidance; Classification Management Training and Security Awareness Panel; Disclosure and Release of Technical Information Panel; and Information Security/Classification Management Career Field Status, challenges and future. GRA

N78-14942# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
JOINT SOURCE AND CHANNEL CODING
James L. Massey Sep. 1977 17 p refs Presented at NATO Advanced Study Inst. Ser.: Commun. Systems and Random Process Theory, Darlington, Engl., 8-20 Aug. 1977 Submitted for publication
(Contract N00014-75-C-1183)
(AD-A045938; ESL-P-773) Avail: NTIS HC A02/MF A01 CSCL 09/4

The advantages and disadvantages of combining the functions of source coding ('data compression') and channel coding ('error correction') into a single coding unit are considered. Particular attention is given to linear encoders, both for sources and for channels, because their ease of implementation makes their use desirable in practice. It is shown that, without loss of optimality, a joint source/channel linear encoder may be used when the goal is the distortionless reproduction of the source at the destination. On the other hand, it is shown that, in general, there is an inherent and significant loss of optimality if a joint source/channel linear encoder is used when the goal is relaxed to reproduction of the source within some specified non-negligible distortion. Author (GRA)

N78-14943# Brookhaven National Lab., Upton, N. Y.
BNL ARCHIVE AND DISSEMINATION SYSTEM
S. Abbey, K. Fuchel, J. Heller, K. S. Lin, and L. Osterer Feb. 1977 27 p refs Presented at SIGMOD Intern. Conf. on Management Data, Toronto, Canada, 3 Aug. 1977
(Contract EY-76-C-02-0016)
(BNL-22424; Conf-770805) Avail: NTIS HC A03/MF A01

The Brookhaven National Laboratory Archive and Dissemination System (BNLADS) is designed to deal with the record keeping associated with archiving and disseminating sequential files through a computer network. This data base management system (DBMS) is implemented in a host language that is a subset of PL/I. The stored sequential files that can be dealt with by the BNLADS must be in character mode (ASCII, BCD, EBCDIC). The accessing of fields is specified by a format description which allows for forward processing of fields only. The structure of a case type statement allows for a data field determining a format sequence from a set of format sequences. A data description language (DDL) was devised to describe the accessing sequences of stored sequential files. A data model definition gives the user a view of the content of each stored sequential file. ERDA

N78-14944# Franklin Inst. Research Labs., Philadelphia, Pa. Science Information Services Dept.
STUDY OF COVERAGE OF ARCTIC RESEARCH BY DISCIPLINE-ORIENTED ABSTRACTING AND INDEXING SERVICES Final Report
Janet R. Orr 28 Jan. 1977 103 p refs
(Grant NSF DPP-76-23373)
(PB-272070/4; FIRL-F-C4468) Avail: NTIS HC A06/MF A01 CSCL 05B

This study was designed to determine if commercial on-line bibliographic services could replace or substitute for the Arctic Bibliography series. The evaluation included using Volume 16 of the Arctic Bibliography as the basis for comparison of journals scanned and articles selected; using two statistical techniques, sequential analysis and sample proportion analysis, to determine journal and citation coverage overlap; and, studying each service to demonstrate ease of retrieving Arctic-related literature. GRA

N78-14945# Applied Communication Research, Inc., Stanford, Calif.
COMPUTER ASSISTANCE IN INFORMATION WORK. PART 1: CONCEPTUAL FRAMEWORK FOR IMPROVING THE COMPUTER/USER INTERFACE IN INFORMATION WORK. PART 2: CATALOG OF ACCELERATION, AUGMENTATION, AND DELEGATION FUNCTIONS IN INFORMATION WORK Final Report, 1 Jul. 1976 - 31 Aug. 1977
William Paisley and Matilda Butler 31 Aug. 1977 106 p refs
(Contract NSF C-76-05489)
(PB-271538/1) Avail: NTIS HC A06/MF A01 CSCL 05B

Information work (the production, distribution, transformation, storage, retrieval, and use of information) is analyzed in terms of information tasks whose underlying perceptual/cognitive

processes can be facilitated by the computer. Part 1 of the report lays out a conceptual framework of perceptual/cognitive processes based on cybernetic and psychological theories. This framework is derivative of the Newell-Simon adaptive information processing system and the Miller-Galanter-Pribram TOTE unit. Twelve perceptual/cognitive processes that the computer can facilitate are scanning, fixating, feature extracting, decoding, comparing, deciding, inducing, deducing, retrieving, selecting, transforming, and producing. Computer functions that can facilitate these processes are exemplified by displaying, analyzing, simulating, editing, etc. Part 2 of the report consists of an illustrative catalog of computer functions that can be implemented via hardware and/or software and concludes with recommendations for R&D to improve computer assistance in information work. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N78-14946# General Accounting Office, Washington, D. C. Community and Economic Development Div.
THE CONCORDE: RESULTS OF A SUPERSONIC AIRCRAFT'S ENTRY INTO THE UNITED STATES
15 Sep. 1977 46 p
(PB-272006/8; CED-77-131) Avail: NTIS HC A03/MF A01 CSCL 05D

Surveys of public opinion during the Concorde trial period at Dulles International Airport to determine community reaction are discussed. The information obtained from these surveys is unreliable and should not be used in the formulation of policy towards the Concorde. Noise complaints received indicate a negative Concorde response. Although GAO's review dealt only with the Concorde's noise aspects, decisions affecting this aircraft are considered to have important implications for the U.S. economy and U.S. international relations. GRA

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

N78-14947*# Caspan Corp., Houston, Tex.
THE FEASIBILITY OF ESTABLISHING OPERATIONAL WATER HYACINTH-BASED SYSTEMS AT THE TREATMENT FACILITIES OF EXISTING CITIES Final Report
Nov. 1977 64 p refs
(Contract NASw-3091)
(NASA-CR-155511) Avail: NTIS HC A04/MF A01 CSCL 13B

The wastewater treatment facilities of three communities in southern Florida and two in southern Texas areas having populations of 20,000 or fewer persons were surveyed to determine: (1) their performance characteristics and the nature of their customers; (2) facility upgrading requirements needed to meet current and future EPA and State standards; (3) their adaptability to water hyacinth utilization and harvested plant disposal; and (4) the level of community support. Guidelines for site selection were established and applied to five cities in Texas and four in Florida. An evaluation of the prospective sites reveals that the Florida locations are generally unsuitable for implementation of water hyacinth based systems because of regulatory philosophy. All five Texas sites have excellent potential. A.R.H.

N78-14948# Sverdrup and Parcel, Inc., St. Louis, Mo.
SLUDGE HANDLING AND DISPOSAL PRACTICES AT SELECTED MUNICIPAL WASTEWATER TREATMENT PLANTS
Apr. 1977 56 p
(Contract EPA-68-01-3289)
(PB-272048/0; EPA-430/9-77-007; EPA-MCD-36) Avail: NTIS HC A04/MF A01 CSCL 13B

The sludge handling practices employed by members of the Association of Metropolitan Sewerage Agencies are described. Dewatering and disposal methods are evaluated with respect to the prevalence of various types of equipment and systems, sludge handling costs, and other factors. Research needs and nontechnical aspects of sludge management are discussed. Composite flow charts are presented to illustrate how the different plants process sewage sludge. Charts are included for primary, secondary, and combined sludges. The quantities of sludge handled by each unit operation and the number of plants using the process are shown. The most commonly used types of equipment in decreasing order of frequency, are anaerobic digestion, gravity thickening, and vacuum filtration. Data on specific types of equipment were correlated with the type of sludge processed, plant size, and other parameters. GRA

N78-14949# JBF Scientific Corp., Washington, D. C.
PERFORMANCE EVALUATION OF EXISTING LAGOONS, PETERBOROUGH, NEW HAMPSHIRE Final Report, 1974 - 1976
Stuart P. Bowen Aug. 1977 105 p
(Contract EPA-68-03-2062)
(PB-272390/6; EPA-600/2-77-085) Avail: NTIS HC A06/MF A01 CSCL 13B

Data were gathered during a one-year period of monitoring the lagoon system at Peterborough, New Hampshire, and the treatment plant performance was compared to design loading rates and the Federal Secondary Treatment Effluent Standards. The lagoon system performed very well with excellent removals of suspended solids and fecal coliform bacteria. BOD5 removal was excellent except for four months during the winter when anaerobic conditions occurred under the ice cover and soluble BOD5 levels rose substantially. As a result of this study, it was recommended that induced-air aeration be installed in one of the ponds to decrease the concentration of soluble BOD5 and thus meet the Federal Standards. Other chemical and physical parameters were monitored in the sampling program and the data is presented in the report. GRA

N78-14950# Freeman, (Peter A.) Associates, Berlin, Md.
EVALUATION OF FLUIDIC COMBINED SEWER REGULATORS UNDER MUNICIPAL SERVICE CONDITIONS Final Report
Aug. 1977 107 p
(Grant EPA-11022-FWR)
(PB-272273/4; EPA-600/2-77-071) Avail: NTIS HC A06/MF A01 CSCL 13B

An evaluation was made of two fluidic combined sewer regulators operated by the city of Philadelphia Water Department under typical municipal service conditions. The smaller unit provided much better hydraulic regulation performance than the conventional static regulator it replaced, approaching that of a complex, dynamic regulator. The large unit demonstrated a similar performance potential which was not practicably achieved because of unforeseen, heavy infiltration in the connecting sewer. Considering both hydraulic performance and costs, the fluidic regulator was considered to offer greater cost effectiveness than either conventional static or dynamic combined sewer regulators. GRA

N78-14951# Swain, (John W.), Wellesley, Mass.
ASSESSMENT IN INDUSTRIAL HAZARDOUS WASTE MANAGEMENT PETROLEUM RE-REFINING INDUSTRY Final Report, Jan. - Nov. 1976
John W. Swain Jun. 1977 162 p refs
(PB-272267/6; EPA/SW-144c) Avail: NTIS HC A08/MF A01 CSCL 13B

A description is given of hazardous waste generation and management in the petroleum re-refining industry - the re-refining of waste oils for use as lubricants and as fuel. The industry's wastes contain such potentially hazardous contaminants as heavy metals, phenols and potentially carcinogenic aromatic hydrocarbons. The report surveys industry characteristics, quantity and character of its potentially hazardous wastes, treatment and disposal technology, and attendant costs. Projections for the production of re-refined oil and generation of wastes have been made for 1977 and 1983. GRA

N78-14952# Michigan Technological Univ., Houghton.
ENERGY AND PROTEIN PRODUCTION FROM PULP MILL WASTES Progress Report, 15 Dec. 1976 - 15 Mar. 1977
M. F. Jurgensen and J. T. Patton Mar. 1977 8 p
(Contract EY-76-S-02-2983)
(COO-2983-3) Avail: NTIS HC A02/MF A01

The feasibility of producing protein and methane from pulp mill waste materials was demonstrated. Ozonated spent sulfite liquor, SSL, was shown to be a suitable substrate for biosynthesis. Sustained production of methane was obtained by biological conversion of ozonated SSL. Total methane production approximated 2 volumes of gas per volume of ozonated SSL after approximately 3 days reaction time. A study of the effect of pH on ozonation indicated that low pH's favotr the breakdown of SSL into organic fragments that are more easily assimilated by microorganisms. Approximately one half as much ozone was required to effect maximum degradation at pH4 as compared to pH8. Even with this lower dosage of ozone the resulting product was more amenable to bioconversion. ERA

N78-14953# Brookhaven National Lab., Upton, N. Y.
NATURAL SEWAGE RECYCLING SYSTEMS
M. M. Small Jan. 1977 40 p refs
(Contract EY-76-C-02-0016)
(BNL-50630) Avail: NTIS HC A03/MF A01

Natural systems which produce potable water from sewage were reviewed. Conventional treatment plant hardware beyond aeration was not used in these prototype marsh/pond and meadow/marsh/pond systems and no sludge was generated. Experiments with two prototype systems are described and performance data are presented in detail for the marsh/pond. Empirical interpretations of results achieved to date are suggested for use in the design of marsh/ponds as natural sewage recycling systems. Construction and operating costs for a proposed 250,000 gpd, state of the art plant are presented. ERA

N78-14954# California Univ., Berkeley. Lawrence Berkeley Lab.
INVESTIGATION OF THE FEASIBILITY OF A DUAL MODEL ELECTRIC TRANSPORTATION SYSTEM
J. G. Bolger and F. A. Kirsten May 1977 159 p refs
(Contract W-7405-eng-48)
(LBL-6301) Avail: NTIS HC A08/MF A01

A study is reported which explores the feasibility of a highway transportation system that electromagnetically transfers energy to vehicles from powered roadways for high-speed or long-range travel, and uses energy stored in the vehicles for other travel. The energy coupling between roadway and vehicle is functionally similar to a transformer. The roadway energy source is imbedded flush with the roadway surface. When vehicle's energy pickups are suspended over the source, energy is magnetically coupled through the clearance gap between source and pickup. Analyses and modeling indicated that adequate power can be efficiently coupled by the system. The economics of the system appear to be favorable, and no implementational problems were identified that would make the system impractical. ERA

N78-14955# Army Natick Research and Development Command, Mass.
PRETREATMENT AND SUBSTRATE EVALUATION FOR THE ENZYMATIC HYDROLYSIS OF CELLULOSIC WASTES
Leo A. Spano, Thomas H. Tassinari, Charles F. Macy, and Edward D. Black Jul. 1977 53 p refs
(Contract EPA-IAG-DS-0758)
(PB-272104/1; EPA-600/7-77-038) Avail: NTIS HC A04/MF A01 CSCL 13B

Studies were done to determine the applicability of various pretreatment methods and existing cellulosic wastes to a process for the conversion of cellulose to glucose and other reducing sugars. In this process, a cellulase from a mutant of Trichoderma viride is used. Pretreatment using differential speed two-roll mills significantly enhanced the susceptibility of diverse cellulosic substrates such as newspaper, cotton, pine and maple. With processing times of less than ten minutes on a six-inch (roll diameter) mill, hydrolysis yield improvements were two and twelve-fold for newspaper and cotton respectively. Anhydrous liquid ammonia treatments of hardwood birch and maple sawdust rendered them more susceptible to enzymatic hydrolysis than substrates from a softwood source, e.g., white pine and newspaper. A combination of pretreatments, two-roll milling followed by liquid ammonia, affected significant increases in hydrolysis yield for maplewood shavings and hammer milled newspaper. GRA

N78-14956# California Univ., Berkeley.
SIGNIFICANCE OF SIZE REDUCTION IN SOLID WASTE MANAGEMENT Final Report
George J. Trezek Jul. 1977 167 p refs
(Grant EPA-R-804034)
(PB-272096/9; EPA-600/2-77-131) Avail: NTIS HC A08/MF A01 CSCL 13B

Research conducted to characterize the size reduction of municipal solid waste (MSW) is reported. Results and data are presented on the relationships between refuse size distribution, particle size, grinding speed, moisture content, energy consumption, and feed rate. Also presented are some basic considerations for designing solid waste shredders. GRA

N78-14957# Culp/Wesner/Culp, El Dorado Hills, Calif.
USER ACCEPTANCE OF WASTEWATER SLUDGE COMPOST Final Report
William F. Ettlich and Anne E. Lewis Aug. 1977 58 p
(Contract EPA-68-03-2186)
(PB-272095/1; EPA-600/2-77-096) Avail: NTIS HC A04/MF A01 CSCL 13B

Existing and past compost and sludge product distribution operations were analyzed to determine the characteristics of the successful operations and the factors that may have led to lack of success or failure of others. Results indicate that demand already exists for waste water sludge compost in certain metropolitan areas and that this demand was developed by implementing a planned program. Similar wastewater sludge product distribution operations have failed in the past because of high pricing or poorly planned programs. A broad characterization of user requirements and desires was developed based on user interviews. GRA

N78-14958# FMC Corp., San Jose, Calif. Advanced Products Div.
DEVELOPMENT OF A SYSTEM FOR CONDUCTING INTER-LABORATORY TESTS FOR WATER QUALITY AND EFFLUENT MEASUREMENTS Progress Report, 16 Jul. 1974 - 15 Apr. 1976
Arthur C. Green and Robert Naegele Jun. 1977 144 p refs
(Contract EPA-68-03-2115)
(PB-272274/2; EPA-600/4-77-031) Avail: NTIS HC A07/MF A01 CSCL 13B

A system was developed for evaluating water pollution data and the laboratories which produce these data. The system consists of a plan for the design and implementation of an interlaboratory test program. A pilot test program was included to evaluate and to verify the complete program. Investigation of ongoing interlaboratory testing programs were conducted and their deficiencies identified in their design and in the procedures by which they were conducted. The conclusions and recommendations presented in the report are supported by an extensive literature review of previous interlaboratory tests and their methods for experimental design and test data analyses. Additionally, 18

EPA, State, and private laboratories were visited to review their comments regarding difficulties and deficiencies in interlaboratory test programs in general. GRA

N78-14959# Gellman Research Associates, Inc., Jenkintown, Pa.
TECHNOLOGY DELIVERY FOR A NEW PARATRANSIT VEHICLE Final Report
J. P. Price, Alain Kornhauser, and Joseph Phillips Jul. 1977 99 p refs
(Contract DOT-UT-70038)
(PB-272128/0; UMTA-PA-06-0039-77-1) Avail: NTIS HC A05/MF A01 CSCL 13F

Suggestions are made for solving the long-standing American transportation need--a large, comfortable taxicab/paratransit vehicle, and it is pointed out that the success of the paratransit program may depend on the technology delivery process. The report highlights the need to take the existing state-of-the-art vehicle technology and to convert it into a disseminated vehicle in the marketplace so that it would be profitable to manufacturers, operators, and users. It focuses specifically on the barriers to delivering a new paratransit vehicle to the industry; it identifies the key issues which will become relevant in the future, as innovators attempt to market a vehicle, and its concomitant services, to the riding public. GRA

N78-14960# Los Angeles County Sanitation District, Whittier, Calif.
INDEPENDENT PHYSICAL-CHEMICAL TREATMENT OF RAW SEWAGE Final Report, Jan. 1973 - Aug. 1975
Leon S. Directo, Ching-Lin Chen, and Robert P. Miele Aug. 1977 119 p refs
(Contract DI-14-12-12-150)
(PB-272514/1; EPA-600/2-77-137) Avail: NTIS HC A06/MF A01 CSCL 13B

A 3.17 l/sec (50 gpm) pilot plant evaluation of the independent physical-chemical treatment (IPC) process was conducted for 27-months at Pomona, California. The pilot plant consisted of chemical clarification w/alum at 25 mg/l as Al and an anionic polymer at 0.3 mg/l followed by a single-stage, pressurized downflow carbon column operated at a hydraulic loading of 2.71 l/sec/sq m (4 gpm/sq ft) and an empty-bed contact time of 30 min. Performance data obtained demonstrated the stability of the IPC system in producing effluent of excellent overall quality. The suspended solids, total COD and total phosphate removals in the IPC system were 96.6%, and 92%, respectively. In the course of the study, several methods of controlling sulfide generation in the carbon column were evaluated. Continuous sodium nitrate addition to the carbon column at an average dosage of 5.4 mg/l N was found most effective in preventing sulfide generation. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N78-14961 State Univ. of New York, Albany.
OPTICAL HETERODYNE MEASUREMENT OF NONCOHERENT SOURCES IN THE VISIBLE Ph.D. Thesis
Ronald William Goebel 1977 100 p
Avail: Univ. Microfilms Order No. 77-18749

In astronomical spectroscopy more efficient use of the incident flux and ever higher resolution are of utmost concern. The optical heterodyne technique using a laser as a local oscillator is a means of down converting optical frequencies to radio frequencies in what is termed electronic spectroscopy. It is a non-dispersive technique which does not require entrance slits; its chromatic resolving power, limited primarily by the bandpass of the associated electronics, can be considerably greater than conventional optical techniques. Although conditions for successful operation of the technique are better in the infra-red, the current work is directed at visible wavelengths where such high resolution is a necessity. In this work, confusion in signal brought about by double sideband detection is considered and shown that at least for single frequencies one sideband can be suppressed by as much as 54db. Dissert. Abstr.

N78-14962 Rice Univ., Houston, Tex.
NUCLEOSYNTHESIS OF LIGHT ELEMENTS IN YOUNG SUPERNOVA REMNANTS SURROUNDING PULSARS Ph.D. Thesis
Eliahu Dwek 1977 117 p
Avail: Univ. Microfilms Order No. 77-19246

It was proposed that (7)Li is produced in the galaxy primarily by collisions in helium-rich nebulae surrounding newly-born pulsars. The proposed model is reexamined for a nebula with a composition that is more characteristic of supernova ejecta, and with a more detailed treatment of the evolution of the energetic particles in the nebula. The major results of this work are: (1) Collisional losses at the early stages of the expansion greatly inhibit the achievement of a (7)Li/(6)Li ratio of 12. (2) To synthesize the required amount of (7)Li and avoid the overproduction of other light elements, at least one-third of the pulsar's total luminosity needs to be converted in a rather special injection spectrum of particles. (3) A characteristic feature of the model is that gamma ray fluxes resulting from the deexcitation of (7)Li*(478 keV) and (7)Be*(431 keV) must exceed those resulting from the 4.44 MeV deexcitation of (12)C* by at least a factor of three. Dissert. Abstr.

N78-14963 Washington Univ., Seattle.
STELLAR EVOLUTIONARY STUDIES OF YOUNG CLUSTERS IN THE LARGE MAGELLANIC CLOUD Ph.D. Thesis
Phillip John Flower 1976 204 p
Avail: Univ. Microfilms Order No. 77-18340

A method for the comparison between color-magnitude diagrams of moderately massive giants and theoretical evolutionary tracks was developed for the purpose of estimating the chemical composition, mass and age of giants in young populous clusters. The theoretical foundation for the comparisons is a grid of fifty evolutionary tracks covering a wide range of chemical composition, mass and mixing length. These tracks and the detailed interior solutions of the models for each time step were used to study the blue loop phenomenon exhibited by moderately massive core helium burning models. The loop onset is found to be sensitive to the opacity above the helium burning core in the sense that the lower the opacity the sooner evolution towards higher effective temperatures commences and related to the collapse phase occurring after helium ignition in the core. Dissert. Abstr.

N78-14964 Pennsylvania Univ., Philadelphia.
PHOTOGRAPHIC RADIOMETRY OF COMET KOHOUTEK (1973f) Ph.D. Thesis
Frank Giovane 1977 341 p
Avail: Univ. Microfilms Order No. 77-19850

Photographic observations of Comet Kohoutek (1973f) were made to determine the dust and emission (OH, CN, C2, Na, and others) morphology. In all 14 whitelight, 5 CN, 3 C2, and 4 Na images of the comet were reduced. The irradiance and radiance maps of both emission and whitelight comet images are given in absolute radiometric units, although the longer exposure emission band images are degraded by poor tracking. The continuum contribution to the emission bands is removed, and the photometric profiles, molecular densities, and precursor production rates calculated. These results are compared where possible with the results of other investigators. Possible sources of error and their magnitude are discussed. In addition, the failure of the brightness prediction for Comet Kohoutek is treated, as are the need for improved comet observations and the significance of the adopted radiometric reduction procedure. Dissert. Abstr.

N78-14965 California Univ., Santa Cruz.
OBSERVATION AND INTERPRETATION OF THE INFRARED SPECTRA OF BRIGHT COMPACT NEBULAE Ph.D. Thesis

Jesse David Bregman 1976 151 p
Avail: Univ. Microfilms Order No. 77-18619

Infrared observations were made of bright nebulae to determine the effect of dust on the ionization structure of these objects. Maps of the 8-14 micron continuum radiation from the dust were made of two planetary nebulae with an infrared photometer to determine the relative positions of the gas and dust. From these maps, it appears that the gas and dust are mixed in NGC 7027, while in BD+30 deg 3639 some dust exists outside of the HII region. A map of the infrared emission lines of SIV and NeII in NGC 7027 indicates that high density clumps comprise at least 10% of the volume of the nebula. Comparison of the 11.3 micron emission to laboratory data indicates that small crystalline MgCO3 particles are responsible for the feature in the planetary nebulae. However, HD44179 has a much broader feature which cannot be accounted for by crystalline MgCO3 particles, but may be explained by amorphous MgCO3 particles. Dissert. Abstr.

N78-14966 Cornell Univ., Ithaca, N. Y.
ASTRONOMICAL POLARIZATION STUDIES AT RADIO AND INFRARED WAVELENGTHS Ph.D. Thesis
Brian Kenneth Dennison 1976 121 p
Avail: Univ. Microfilms Order No. 77-19994

The gravitational field is probed in a search for polarization dependence in the light bending. This involves searching for a splitting of a source image into orthogonal polarizations as the radiation passes through the solar gravitational field. The total polarization of the Helios 1 carrier wave was sought as the spacecraft passed behind the sun. No polarization splitting was detected, and the most stringent upper limits are about 5 x 10 to -8 power arc seconds. This constitutes a unique confirmation of the equivalence principle. The possibility of the involvement of far infrared polarization of dust clouds is discussed. The recently observed 10 micron polarization of the Orion Nebula and the Galactic Center suggests that far infrared polarization may be found in these objects. Estimates are made of the degree of far infrared polarization that may exist in the Orion Nebula. A first attempt to observe far infrared polarization from the Orion Nebula was carried out. Dissert. Abstr.

N78-14967 Princeton Univ., N. J.
A SEARCH FOR A HALO AROUND NGC 3877 WITH A CHARGE COUPLED DETECTOR Ph.D. Thesis
Edwin Din Loh 1977 159 p
Avail: Univ. Microfilms Order No. 77-19179

An account is given of the Fairchild charge-coupled device used as an astronomical detector. The properties of the device, its applicability, and its particular problems are discussed with special emphasis on the noise and spatial flatness of the quantum efficiency. An attempt is made to detect a giant halo around the edge-on spiral galaxy NGC 3877. Deep pictures were taken with a cooled charge-coupled detector in five colors from 550 nm to 1000 nm. At 950 nm, the luminosity outside of the disk is (1.5 + or - 1.8)% (1 standard deviation) of the luminosity ratio in the halo is 66 superscript + infinity and subscript -36 times that of the disk if the halo is as massive as the one suggested by Ostriker and Peebles to stabilize the disk. Dissert. Abstr.

N78-14968*# McDonald Observatory, Austin, Tex.
REPORT ON THE LUNAR RANGING AT MCDONALD OBSERVATORY Research Report, 19 Jun. - 12 Oct. 1977
E. C. Silverberg Oct. 1977 42 p
(Grant NGR-44-012-165)
(NASA-CR-155412; RM-77-005) Avail: NTIS HC A03/MF A01 CSCL 03A

Range measurements to an accuracy of 5 cm were achieved following improvements in the laser oscillator configuration and the photomultiplier system. Modifications to the laser include a redesigned pockel cell mount to eliminate stressing of the cell crystal; an improved electrically triggered spark gap for sharpening the electrical pulse; the use of a brewster plate in the cavity to eliminate pre-pulsing; improved alignment for the oscillator system; and increased cavity lifetime through thin film polarizer technology. Laser calibration data are presented along with the lunar laser operations log for June to October 1977. Author

N78-14969# Wisconsin Univ., Madison. Washburn Observatory
ULTRAVIOLET OBSERVATIONS OF TWO HOT STARS WITH INFRARED EXCESSES FROM CIRCUMSTELLAR DUST
B. D. Savage, P. R. Wesselius (Groningen Univ., Netherlands), J. P. Swings (Liege Univ.), and P. S. The (Amsterdam Univ.) 1977 32 p refs
Avail: NTIS HC A03/MF A01

The five channel ultraviolet grating spectrophotometer aboard the Astronomical Netherlands Satellite (ANS) was used to observe HD 45677 and HD 50138. Both objects are peculiar Be stars exhibiting infrared excesses attributed to circumstellar dust. Neither object has an ultraviolet spectral energy distribution resembling the distributions expected for stars surrounded with normal interstellar dust. The HD 45677 has a relatively strong 0.22 micrometer absorption feature that appears to be of circumstellar origin. The HD 50138 has at most a weak 0.22 micron feature. However, this star does appear to be variable and to have a broad ultraviolet absorption feature peaking in strength at a wavelength longward of 0.22 micrometer. If the day to day and month to month ultraviolet spectral variability of HD 50138 is due to the passage of inhomogeneous clouds of circumstellar dust in front of the star, then the ANS data imply that the local dust peaks in absorption near 0.25 micrometer. Author

N78-14970*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CYGNUS A AT 99 GHz: OBSERVATIONS OF THE THREE PRINCIPAL COMPONENTS AND INTERPRETATION OF THE CENTRAL SOURCE
Robert W. Hobbs, Stephen P. Maran, Minas Kafatos, and Larry W. Brown Nov. 1977 17 p refs
(NASA-TM-78068; X-685-77-272) Avail: NTIS HC A02/MF A01 CSCL 03A

The three principal emission components of Cygnus A were observed at 99 GHz, the highest frequency at which radio measurements of this source have been accomplished. The observations show no definite indication of a high-frequency cutoff in the spectrum of the compact central component, which perhaps may be attributed to an optically thin synchrotron source that peaks at a frequency of several hundred GHz. Author

N78-14971# Geneva Observatory (Switzerland).
CATALOGUE OF THE PHOTOMETRIC PARAMETERS FOR STARS MEASURED IN THE GENEVA OBSERVATORY SYSTEM
F. Rufener 1977 78 p refs
(Publ-Ser-B-Fasc-2) Avail: NTIS HC A05/MF A01

The most frequently used photometric parameters and color indices are computed for 4670 stars measured in the photometric system of the Geneva Observatory. Concise bibliographic information as well as the V magnitude are given. Author (ESA)

N78-14972# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
ON THE INFLUENCE OF CARBON ABUNDANCE IN STELLAR OPACITIES
L. Rossi Feb. 1977 14 p refs
(LPS-77-1) Avail: NTIS HC A02/MF A01

The aim of the study was to show that with X = 0.699 and Z = 0.001 through varying the carbon abundance of pop. II stars with a factor of 3, the Rosseland atmospheric opacity does not change very much so that by varying the carbon abundance, the evolution study may be performed without the necessity of computing new opacity tables, as far as the evolution of the external layer is concerned. The atmospheric model program, ATLAS 5, in the SAM 1 version of the University College of London was used. From computing the three stellar atmosphere models with different carbon abundance but the same physical and chemical parameters, it is deduced that the Rosseland opacity is not very sensitive to X sub C. ESA

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N78-14973 Rice Univ., Houston, Tex.
THREE-DIMENSIONAL DYNAMICS OF PROTOSTELLAR EVOLUTION Ph.D. Thesis
Thomas Leroy Cook 1977 292 p
Avail: Univ. Microfilms Order No. 77-19242

A three-dimensional finite difference numerical methodology was developed for self-gravitating, rotating gaseous systems. The fully nonlinear equations for time-varying fluid dynamics are solved by high-speed computer in a cylindrical coordinate system rotating with an instantaneous angular velocity, selected such that the net angular momentum relative to the rotating frame is zero. The time-dependent adiabatic collapse of gravitationally bound, rotating, protostellar clouds is studied for specified uniform and nonuniform initial conditions. The fragmentation of protostellar clouds is investigated by studying the response of rotating self-gravitating, equilibrium toroids to non-axisymmetric perturbations. The detailed evolution of the fragmenting toroid depends upon a non-dimensional function of the initial entropy, the total mass in the toroid, the angular velocity of rotation, and the number of perturbation wavelengths around the circumference of the toroid. Dissert. Abstr.

N78-14974# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
A STUDY OF THE FORBUSH DECREASE EFFECT: THE ORIGIN AND THE DEVELOPMENT IN THE INTERPLANETARY SPACE
N. Iucci (Rome Univ.), M. Parisi, M. Storini, and G. Villoresi Feb. 1977 93 p refs
(LPS-77-2) Avail: NTIS HC A05/MF A01

A catalogue of all Type IV radiobursts and all Forbush decreases (Fds) observed by neutron monitor stations at high latitude from July 1957 to December 1969 is presented. Only the Type IV, energetic and well extended in frequency, were found to produce Fds of appreciable amplitude. The dependences of the distinctive parameters of the Fds (amplitude, average sun-earth velocity, decreasing and recovery phases) on the coordinates of the parent Type IV solar flares are in agreement with those expected from the corotative model of Fds; the modulated region corotates with the sun and covers a wide portion of the interplanetary space: average extension approx. 130 deg with a region of approx. 70 deg of maximum cosmic ray depression (core) shifted towards the leading edge. The Fd amplitude in the core is found to be correlated with the average velocity of the perturbation between the sun and the earth's orbit and the intensity tends to recover with a time constant tau approx. 11 days. A study on the time behavior and on the amplitude distribution of the Fds not associated with observed Type IV solar flares shows that these events are mainly produced by Type IV occurring in the not visible hemisphere of the sun.
Author (ESA)

N78-14975# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
STAR FORMATION IN A DUSTY PLASMA CLOUD
Hannes Alfven Jun. 1977 10 p refs
(TRITA-EPP-77-15) Avail: NTIS HC A02/MF A01

The formation of a star in a plasma cloud dust is discussed. A dusty plasma cloud in space has a gravitational instability which allows star formation even at orders of magnitude below the Jean's limit for gravitational collapse. This instability leads to a stellesimal accretion which is analogous to the planetesimal accretion. If the law of isochronism which holds for planetesimal accretion is applied to the formation of our sun, it gives an acceptable angular momentum to the early sun. Furthermore, the situation in the solar environment is reconcilable with the initial condition for formation of planets. Author (ESA)

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N78-14976*# Kansas State Univ., Manhattan. Dept. of Physics.
INFRARED LABORATORY STUDIES OF SYNTHETIC PLANETARY ATMOSPHERES Semiannual Status Report, 1 Jun. - 30 Nov. 1977
Dudley Williams 20 Dec. 1977 64 p refs
(Grant NGR-17-001-026)
(NASA-CR-155413) Avail: NTIS HC A04/MF A01 CSCL 03B

Topics covered include: the broadening of individual lines in the CO fundamental by various gases; total band absorptance as a function of absorber thickness and total effect pressure at various temperatures for bands of CO and N2O; nitric acid vapor content in the region of the ozone layer; optical properties of solid NH3; HSO4 concentration in Venus clouds; Burch's law of multiplicative transmittance for mixing absorbing gases when their lines are broadened by helium and hydrogen; line strength and self-broadening parameters in the v3 fundamental of CO2 and N2O; optical constants of liquid ammonia, liquid methane, saturated hydrocarbons, ammonium hydride and ammonium salts. A.R.H.

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N78-14977 Stanford Univ., Calif.
LARGE-SCALE PERIODIC SOLAR VELOCITIES: AN OBSERVATIONAL STUDY Ph.D. Thesis
Phil Howard Dittmer 1977 213 p
Avail: Univ. Microfilms Order No. 77-18208

Observations of large scale solar velocities were made using the mean field telescope and Babcock magnetograph in the magnetically insensitive iron line at 5124 Angstroms. Light from the center of the disk right circularly polarized was used in order to measure the difference in wavelength between center and limb. Individual observations showed five minute oscillations. From power spectra, the amplitude was 2.0 meters/second, and the period was 312.9 + or - 0.9 seconds. The amplitude gave evidence for a horizontal wavelength greater than 20,000 kilometers, and the period was larger than reported for smaller apertures. Daily observations were examined for changes in oscillatory power or period that might be associated with large scale coronal and solar wind structures. No evidence for large scale organization of the oscillations was found. Dissert. Abstr.

N78-14978# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
PLASMA KINETICS IN THE SOLAR WIND
M. Dobrowolny and G. Moreno Feb. 1977 98 p refs
(LPS-77-4) Avail: NTIS HC A05/MF A01

The observations and theoretical ideas concerning the role of kinetic processes in the solar wind are discussed. This includes the measurements on distribution functions of plasma electrons and protons, the relation of the observed nonthermal electron features with the concept of an exospheric expansion of the solar corona, and the connection of nonthermal proton distributions with bulk flow inhomogeneities of the wind. The present understanding of the connection between observed features of the particle distributions and anomalous values of some plasma transport coefficients, which in turn determine the actual values of macroscopic plasma parameters, is discussed. Possible kinetic processes occurring within small scale structures in the solar

wind, such as collisionless shocks, various types of discontinuities, and D sheets are reviewed. Author (ESA)

N78-14979# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
THE THREE-DIMENSIONAL STRUCTURE OF THE PROTON DISTRIBUTION FUNCTION OF THE SOLAR WIND BASED ON MEASUREMENTS OF HEOS-A2-S-210 [DIE DREIDIMENSIONALE STRUKTUR DER PROTONEN-VERTEILUNGSFUNKTIONEN DES SOLAREN WINDES NACH MESSUNGEN VON HEOS-A2-S-210]
Hans-Peter Herbst May 1977 178 p refs In GERMAN
(MPI-PAE/Extraterr-135) Avail: NTIS HC A09/MF A01

The proton distribution function of the solar wind near earth was measured with an electrostatic quarter-sphere analyzer of the S-210 experiment onboard the HEOS-A2 satellite. This equipment allowed high accuracy due to its three-dimensional resolution. A mathematical method was developed for determining the distribution function by adaptation of a tri-Maxwell model to the measured data, approximately eliminating the effect of the instrument's characteristics. This method was used for evaluation of HEOS-A2 solar wind data on a routine basis. A physical interpretation of the results is presented. ESA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N78-14980*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE RADIAL VARIATION OF COROTATING ENERGETIC PARTICLE STREAMS IN THE INNER AND OUTER SOLAR SYSTEM
M. A. I. VanHollebeke (Maryland Univ., College Park), F. B. McDonald, J. H. Trainor, and T. T. vonRosenvinge Dec. 1977 43 p refs Submitted for publication
(NASA-TM-78040) Avail: NTIS HC A03/MF A01 CSCL 03B

The radial gradient of long-lived, corotating energetic particle streams was measured using observations of .9-2.2 MeV protons from Helios 1 and 2, IMP 7, Pioneer 10 and Pioneer 11. A positive gradient of approximately 350% per AU is found between .3 AU and 1 AU. Between 1 AU and some 3-5 AU, the gradient is variable with an average value of 100% per AU which is consistent with earlier statistical results. A comparison between measurements at 9 AU and approximately 4 AU shows a negative gradient which is variable from -40 to -100% per AU. Possible solar latitudinal effects on these gradient studies are also discussed. Using solar wind and magnetic field data from Helios 1 between 1 AU and .3 AU, the relation between corotating energetic particle events in the inner solar system and the interplanetary medium is examined. It is found that the energetic particles are contained inside the high speed solar wind stream in a region adjacent to the interaction region between low speed and high speed streams. Author

N78-14981*# Aerospace Corp., El Segundo, Calif.
ULTRA-HEAVY COSMIC RAYS: THEORETICAL IMPLICATIONS OF RECENT OBSERVATIONS
J. B. Blake, K. L. Hainebach (Calif. Univ., Livermore. Lawrence Livermore Lab.), D. N. Schramm (Chicago Univ.), and J. D. Anglin (Chicago Univ.) 15 Dec. 1977 37 p refs
(Grants NGL-14-001-006; NsG-7212; NSF AST-74-21216; NSF AST-76-21707; NSF DES-GA-38913X; NSF ATM-75-20407)
(NASA-CR-155512; ATR-78(9461)-2) Avail: NTIS HC A03/MF A01 CSCL 03B

Extreme ultraheavy cosmic ray observations (Z greater or equal 70) are compared with r-process models. A detailed cosmic ray propagation calculation is used to transform the calculated source distributions to those observed at the earth. The r-process production abundances are calculated using different mass formulae and beta-rate formulae; an empirical estimate based on the observed solar system abundances is used also. There is the continued strong indication of an r-process dominance in the extreme ultra-heavy cosmic rays. However it is shown that the observed high actinide/Pt ratio in the cosmic rays cannot be fit with the same r-process calculation which also fits the solar system material. This result suggests that the cosmic rays probably undergo some preferential acceleration in addition to the apparent general enrichment in heavy (r-process) material. As estimate also is made of the expected relative abundance of superheavy elements in the cosmic rays if the anomalous heavy xenon in carbonaceous chondrites is due to a fissioning superheavy element. Author

N78-14982# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
MATTER-ANTIMATTER ANNIHILATION AND THE COSMIC GAMMA-RAY BURST
James R. Vincent Dec. 1976 29 p refs
(TRITA-EPP-76-12) Avail: NTIS HC A03/MF A01

The argument for matter-antimatter symmetry in the universe is reviewed. It is found that, based on known physical laws and processes, the universe should be symmetric. In particular there is no known process to create the major elementary particles that does not involve the creation of an equal number of antiparticles. The cosmology of such a universe is discussed without reference to assumed initial conditions or the postulation of new physical laws. In a review of arguments against the existence of large quantities of antimatter it is shown that there is no observational evidence that preclude matter symmetry, in fact it cannot be said whether or not the nearest star is matter or antimatter. The observation of cosmic gamma-ray bursts is also dealt with. It is suggested that these events are the result of matter-antimatter collisions and the case of an anticomet falling into a Koinostar is discussed. It is shown that the mass/energy, collisional frequency, and spatial distribution is in agreement with current observational data. Author (ESA)

99 GENERAL

N78-14983# European Space Agency, Paris (France).
LA RECHERCHE AEROSPATIALE. BI-MONTHLY BULLETIN NO. 1976-5
Oct. 1977 90 p refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-5, Sep.-Oct. 1976 p 251-300 Original French report available from ONERA, Paris FF 30
(ESA-TT-405) Avail: NTIS HC A05/MF A01

The following topics are dealt with: algorithm for parameter identification from linear observations in the case of incomplete initial estimates, low fatigue crack propagation rates of aluminum and four aluminum alloys, convection and refraction of acoustic waves in open wind tunnel flow in connection with aircraft jet noise propagation, and closure conditions in the case of multiconnected shells. For individual titles, see N78-14984 through N78-14987.

N78-14984# European Space Agency, Paris (France).
ALGORITHM FOR PARAMETER ESTIMATION FROM LINEAR OBSERVATIONS IN THE CASE OF INCOMPLETE INITIAL ESTIMATES c64
Claude Aumasson *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1976-5 (ESA-TT-405) Oct. 1977 p 1-15 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-5, Sep.-Oct. 1976 p 251-257 Original report in FRENCH previously announced as A77-16145 (For availability see N78-14983 05-99)
Avail: NTIS HC A05/MF A01

In parameter identification from a series of linear observations, the method of recursive least squares requires parameter observability, and the Kalman filter technique requires an estimate and initial covariance. An algorithm is described which generalizes these classical methods and which can be applied in particular when certain parameters are completely unknown a priori. A

method for constructing the pseudo-inverse of an arbitrary matrix is derived from the results. ESA

N78-14985# European Space Agency, Paris (France).
LOW FATIGUE CRACK PROPAGATION RATES OF ALUMINUM AND FOUR ALUMINUM ALLOYS c39
Guy Ramusat and Georges Vidal *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1976-5 (ESA-TT-405) Oct. 1977 p 16-30 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-5, Sep.-Oct. 1976 p 259-268 Original report in FRENCH previously announced as A77-16146 (For availability see N78-14983 05-99)
Avail: NTIS HC A06/MF A01

Fatigue fracture tests were performed on 1.5 to 2 mm thick sheets of aluminum and the four aluminum alloys 2024, 5056, 7075, and 2618A. The crack propagation rates were determined to be in the range 10 to the -6th to 10 to the -3d mm/cycle. It was found that for a crack propagation rate of 10 to the -6th mm/cycle, the stress intensity factor difference is almost identical at 3.0 to 3.5 MNm/1.5 for the four alloys. At this same crack propagation rate, the stress intensity factor difference threshold is attained for the 1050A alloy but not for the other alloys. The stress intensity factor difference reaches a value of 7 MNm/1.5 for cold-worked aluminum. Author (ESA)

N78-14986# European Space Agency, Paris (France).
CONVECTION AND REFRACTION OF ACOUSTIC WAVES IN AN OPEN WIND TUNNEL FLOW c71
Sebastien Candel and Alain Guedel *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1976-5 (ESA-TT-405) Oct. 1977 p 31-63 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-5, Sep.-Oct. 1976 p 269-288 Original report in FRENCH previously announced as A77-16147 (For availability see N78-14983 05-99)
Avail: NTIS HC A06/MF A01

Experimental and theoretical results of a study of acoustic propagation in an open wind tunnel are described. The analysis is principally concerned with the modification of source radiation by a uniform flow and the refraction effects occurring in the shear layer due to the existence of a mean velocity gradient. These phenomena are characterized experimentally by measuring the mean field phase and amplitude. Analysis of the phase functions indicates the geometrical nature of the propagation and justifies the reliance on the geometrical approximation for the prediction of the sound field. For the sound source submerged in the wind tunnel jet, this method, combined with an analysis of the modification of the radiation pattern inside the flow, is used to calculate the amplitude distributions outside the flow. Author (ESA)

N78-14987# European Space Agency, Paris (France).
CLOSURE CONDITIONS IN THE CASE OF MULTICONNECTED SHELLS c39
Roger Valid *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1976-5 (ESA-TT-405) Oct. 1977 p 64-87 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-5, Sep.-Oct. 1976 p 289-299 Original report in FRENCH previously announced as A76-46362 (For availability see N78-14983 05-99)
Avail: NTIS HC A06/MF A01

The problem of writing the closure conditions of surface deformations in the case of shells has usually been examined from the local point of view; however, the case of multiconnected shells needs the formulation of some global closure conditions, which are integral conditions on the boundary. It is proposed to provide these closure conditions, both local and global, within the framework of a surface theory in the two cases most utilized in numerical applications, defined by whether the transverse shear energy is taken into account. This difference is introduced by means of appropriate kinematica assumptions using an original fully intrinsic method of differential Riemann geometry. Poincare's theorem is applied for the formulation of the local conditions, while Rham's theorem is combined to write the global closure conditions. Author (ESA)

N78-14988# European Space Agency, Paris (France).
LA RECHERCHE AEROSPATIALE. BI-MONTHLY BULLETIN NO. 1977-3
Sep. 1977 158 p refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-3, May-Jun. 1977 p 133-204 Original French report available from ONERA, Paris FF 30
(ESA-TT-415) Avail: NTIS HC A08/MF A01

The following topics are presented: rain erosion prediction of slip cast fused silica radomes for high speed missiles, drag-free satellite motion modelling, intermittency in boundary layer transition, unsteady turbulent boundary layers, stress corrosion mechanism in Al-Zu-Mg-Cu alloy, and cracking threshold after overloading. For individual titles, see N78-14989 through N78-14994.

N78-14989# European Space Agency, Paris (France).
PREDICTION OF THE RAIN EROSION OF SLIP-CAST FUSED SILICA RADOMES FOR HIGH VELOCITY MISSILES c15
Daniel Balageas *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-3 (ESA-TT-415) refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-3, May-Jun. 1977 p 133-137 Original report in FRENCH previously announced as A77-38743 (For availability see N78-14988 05-99)
Avail: NTIS HC A08/MF A01 Sep. 1977 p 1-11

Results of previously published studies are examined. It is shown that laws describing the erosion process derived using the results of ONERA subsonic rotating arms tests are compatible with results obtained in Air Force tests of missile radomes on the Holloman installation. The Pearson law is found to be applicable to slip-cast fused silica for angles of impact encountered by missiles. The maximum exposure to rain of a given intensity which is possible without serious compromise of mechanical and radio-electric integrity was determined for radomes with different apex angles used in subsonic or supersonic missiles. Author (ESA)

N78-14990# European Space Agency, Paris (France).
ANALYTICAL MODELLING OF THE MOTION OF A DRAG-FREE SATELLITE c34
Alain Clochet and Francoise Paitel *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-3 (ESA-TT-415) Sep. 1977 p 12-31 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-3, May-Jun. 1977 p 139-146 Original report in FRENCH previously announced as A77-10973 (For availability see N78-14988 05-99)
Avail: NTIS HC A08/MF A01

The evolution of a satellite orbit is described by a first-order vector differential equation which can be expressed linearly as a function of the zonal and tesseral coefficients of the earth potential. The use of a given model of potential requires the truncation of this development and a choice in the values of these coefficients. Linearization of the differential equation about an orbit close to the solution yields direct or indirect effects of very different significance. Analysis of these effects permits expansion of the linearized equation by means of the Lagrange perturbation equations. A complete solution of the problem leads to simple analytical relationships describing, for small orbital eccentricities, the motion of a satellite subjected to gravitational forces only. Two analytical models were developed, and the most accurate was compared with a high-performance numerical integration. This model, applied to a quasi-polar small-eccentricity (0.001) orbit, provides a precision of better than 200 m in the orbital parameters after 40 days, although less along the orbit. An extension of this model is proposed for orbits of larger eccentricities. Author (ESA)

N78-14991# European Space Agency, Paris (France).
STUDY OF INTERMITTENCY IN THE TRANSITION ZONE OF A BOUNDARY LAYER c34
Daniel Arnal and Jean-Claude Juillen *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977 - 3 (ESA-TT-415) Sep. 1977 p 32-70 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977 - 3, May-Jun. 1977 p 147-166 Original report in FRENCH previously announced as A77-38744 (For availability see N78-14988 05-99)
Avail: NTIS HC A08/MF A01

The intermittency phenomenon was studied by conditional sampling of the hot wire signal; laminar and turbulent properties of the flow during transition were separately determined by this

technique. The conditional sampling led to detailed information for mean velocities and turbulence energy of successive laminar and turbulent flows; particularities of turbulence profiles are explained. The properties of turbulent spots of different durations and the establishment of well defined characteristics of the longest spots are also dealt with. Author (ESA)

N78-14992# European Space Agency, Paris (France).
RESEARCH ON UNSTEADY TURBULENT BOUNDARY LAYERS **c34**
Jean Cousteix, Andre Desopper, and R. Houdeville *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-3 (ESA-TT415) Sep. 1977 p 71-96 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-3, May-Jun. 1977 p 167-177 Original report in FRENCH previously announced as A77-28936 (For availability see N78-14988 05-99)
Avail: NTIS HC A08/MF A01

The unsteady-state turbulent boundary layer on a fixed wall subjected to a pulsating external flow was studied in an experimental setup involving a periodic flow produced by a rotating butterfly located in the diffuser of an Eiffel type subsonic wind tunnel. A statistical treatment of the experimental data permits separate analysis of the periodic component and the turbulent fluctuation of the velocity, which are measured by hot wire anemometry. A numerical method is presented for solving the local equations by means of a mixing length scheme or a system of transport equations. An integral method of prediction was also developed. Theoretical results are compared to experimental findings and to other prediction methods. Author (ESA)

N78-14993# European Space Agency, Paris (France).
EXPERIMENTAL EVIDENCE OF TWO STRESS CORROSION MECHANISMS IN AN Al-Zn-Mg-Cu ALLOY **c26**
C. Renon and H. Martinod *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-3 (ESA-TT415) Sep. 1977 p 97-124 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-3, May-Jun. 1977 p 179-190 Original report in FRENCH previously announced as A77-38745 (For availability see N78-14988 05-99)
Avail: NTIS HC A08/MF A01

Stress corrosion cracking in thick (60mm) sheets of the Al-Zn-Mg-Cu alloy AZ5GU (7075) immersed in a chloride solution and stressed in the short transverse direction was investigated. The resistance to stress corrosion of specimens obtained by different tempering processes was related to results of micrographic studies of initial stages of crack propagation in these materials. It was found that crack initiation can occur by two mechanisms: electrochemical erosion along grain boundaries and mechanical opening at the bottom of simple corrosion pits. The type of cracking which is privileged in a given alloy is strictly a function of the precipitation state and is independent of corrosion conditions; however, corrosion conditions strongly influence the ease with which crack initiation and propagation occur.
Author (ESA)

N78-14994# European Space Agency, Paris (France).
MEASUREMENT AND CALCULATION OF THE CRACKING THRESHOLD AFTER OVERLOADINGS **c39**
Jacques Pellas, Georges Baudin, and Michel Robert *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-3 (ESA-TT415) Sep. 1977 p 125-155 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-3, May-Jun. 1977 p 191-204 Original report in FRENCH previously announced as A77-38746 (For availability see N78-14988 05-99)
Avail: NTIS HC A08/MF A01

The effective stress-intensity factor, which makes it possible to retain the form of the Paris law, is defined using the crack propagation threshold. A cracking law is then formulated in the form of two equations, one relating the crack propagation rate to the effective stress intensity factor, the other defining the threshold evolution as a function of cycle number. The variation of this threshold under the effect of one or several overloadings was investigated. A threshold measuring process is described and various loading cases are analyzed. A model is presented describing the evolution of the cracking threshold for the loading regimes considered. Good agreement between experimental data and theoretical results is demonstrated. Author (ESA)

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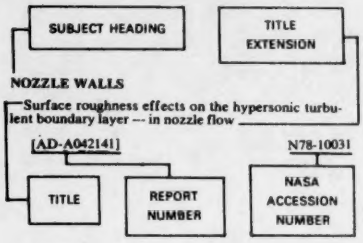

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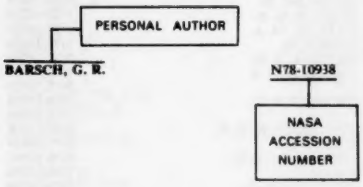

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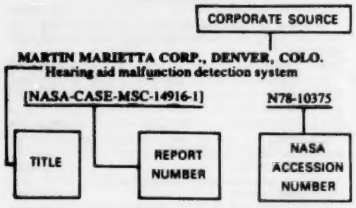

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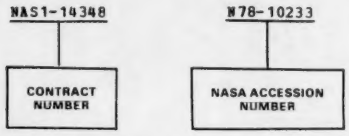

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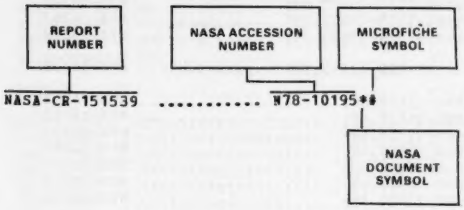

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